AMATEUR WORK

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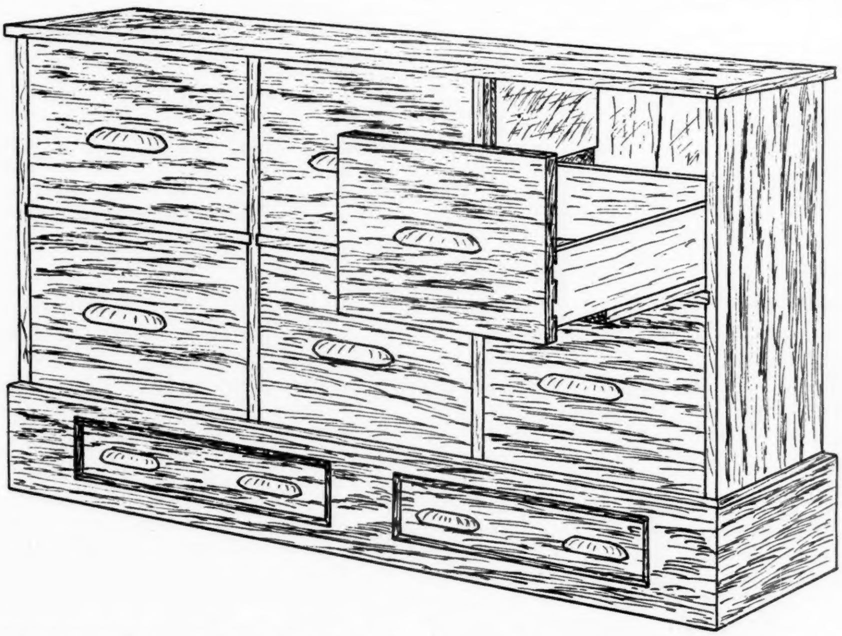
VERTICAL FILING CABINET.

JOHN F. ADAMS.

The filing of letters by what is known as the vertical method is rapidly replacing the old method of letter files with firms receiving any considerable number of letters, especially where the larger portion of the correspondence is confined to the same people. Numbers are assigned to regular correspondents and all letters received and copies of answers thereto are kept in the same folder, an alphabetical index with folder numbers enabling the set of letters to be obtained in the time necessary to look at the index and select the proper folder.

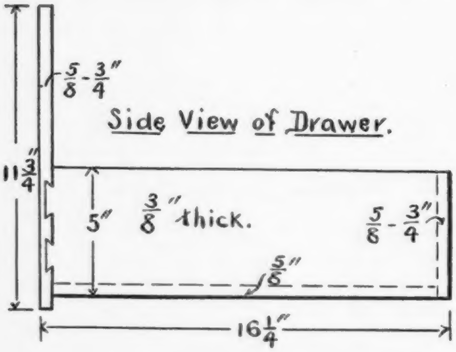


Folders are made from sheets of tag-stock, a kind of thin cardboard much resembling that used for post-cards and shipping tags. They are cut 18¼ x 11½ in. and folded so that one flap measures 9 x 11½ in. and the other 9¼ in., the wider one being placed underneath and filed to bring it at the back. These can be purchased of office supply dealers, but are much cheaper, if the tag stock is obtained from a paper house, where the cutting may be done at small expense and the folding done by the purchaser.

The cabinet of drawers in which the correspondence is filed is usually of the sectional type, allowing the addition of sections as may be required by the increase in letters. As transfers of old letters can be made to the regular type of letter files, the cabinet

here described is not made after the sectional plan, as the six drawers provide a great enough capacity for the needs of any except large firms who would not be interested in making their own furniture. The lower drawers are used for general correspondence filed alphabetically; the upper ones for firms with special numbers. Oak for a stained finish is the wood most suitable to use, although gumwood will make an excellent appearance.

The two end pieces are 31 in. long, 17 in. wide and ⅞ in. thick. The width of these pieces require glueing up from two pieces of suitable width, using care to match the grain as well as possible at the joints. In the rear inner edges of both ends and top cut ½ in. rabbets to receive the sheathing at the back. Also, on the inner sides of the end pieces and 12 in. from the top ends, cut grooves 3-16 in. deep and ⅞ in. wide for receiving the ends of the frame dividing the upper and lower drawers and forming the runs for the upper ones. The top should be attached to the ends with 2 two in. No. 12 wood screws, countersinking the heads, and measures 43 in. long and ⅞ in. thick.



The pieces around the base are 7 in. wide and ⅞ in. thick, the two at the ends being 17⅞ in. long, and the one at the front 43 in. long, these lengths allowing for mitred joints at the corners. If drawers are desired in which to store a supply of folders, the front baseboard is cut as follows:

Draw vertical lines 4 in. from each end and 2 in. each side of the center, connect these with lines 1 in. from the top and 1½ in. from the bottom edge, forming rectangles 16 in. long and 4 in. high. Bore a ¾ in. hole in one corner at each end, and with a compass saw start sawing until a rip saw can be used. The vertical cuts will have to be made entirely with the compass saw. Use care not to saw outside of the lines, and trim up smooth with a chisel and block plane. The fronts of the drawers will have to be made of other pieces, as unless one has a fret saw it is a difficult matter to cut out pieces in this way and have them fit well enough to use as indicated.

The frame forming the runs for the lower drawers is next in order. This measures 39½ in. long and 16½ in. wide. The piece forming the front edge, 3 in. wide, should be of the same wood used for the ends and top; the rest of the frame may be of birch or maple, the back pieces being 3 in. wide and the end pieces 3½ in. wide. The joints are halved, the ends having the cuts on the under side. Two cross pieces 3 in. wide, also with halved joints, are placed with centers 14¼ in. from each end. The joints with the front piece should not be cut clear across, but about ½ in. left to conceal the ends of the cross pieces and ends.

Two partitions 24 in. high and 16½ in. wide are now made of wood ⅝ in. thick. If maple or birch be used, glue a 2 in. strip of the wood used for ends to the front edge. It will be necessary to cut grooves ⅛ in. deep and ⅞ in. wide, across the center of each side of these partitions to receive the frames forming the runs for the upper drawers.

These latter frames are 13 1-16 in. wide, 16¼ in. deep, and ⅞ in. thick, made with halved joints, the front pieces matching the rest, as before mentioned. Stock 3 in. wide is used, and the frames are firmly attached in place with glue and nails. The joints between these frames and the partitions can be nicely concealed by having the frames only 16 in. deep, setting them in ½ in., cutting into the partitions at the joints ½ in. and putting a strip ⅞ x ½ in. and 39¾ in. long, across the front, using glue and wire finish nails for fastening.

The runs for the two shallow storage drawers are next to be made. Four pieces of birch or any similar wood, 4 3-16 in. wide and 16½ in. long, are then nailed with the front ends flush with the openings, the top edges being attached with 2 in. screws to the frame above. To the under edges of these pieces, attach strips 2 in. wide and 16½ in. long, so that they will project towards each other, forming runs for the drawers. Under these place two strips 39½ in. long and of just the width to rest on the floor, and thus give firm support to the runs of the drawers and enabling the latter to be heavily loaded. The two drawers are of ordinary construction, with the exception that around the edges of the front may be placed strips of quarter moulding, and the drawer set in to bring the moulding flush with the front. This recessed effect adds to its appearance. A single drop drawer pull in the center of the drawer will answer. The frame is finished by sheathing up the back with ½ in. matched sheathing, which comes 6 in. wide. Seven strips 25½ in. long will be required.

The filing drawers, six in number, are next to be made. The fronts consist of six pieces 12¾ in. long, 11¾ in. wide and ¾ in. thick. As the sides are low it will be necessary to cut down the ends on the front sides for cleats 2 in. wide and ½ in. thick, which are desirable to prevent warping. Use care to make good joints; the cleats should be glued and held in clamps while the glue is drying. Cut rabbets on the inner

lower edge $\frac{5}{8}$ x $\frac{7}{8}$ in. for the ends of the bottom board. The sides are 16 in. long, 5 in. wide and $\frac{5}{8}$ in. thick, the fronts having a $\frac{1}{2}$ in. rabbet to receive them, fastening carefully with $1\frac{1}{2}$ in screws of small gauge, and glue. Dovetail joints would be stronger, and are recommended to those knowing how to cut them. The piece at the back is 12 in. long, $4\frac{5}{8}$ in wide and $\frac{3}{4}$ in. thick, the top edge being nailed flush with the side pieces. The bottom is 16 in. long, 12 in. wide and $\frac{5}{8}$ in. thick, the rear end being nailed to the back with nails or screws through the sides and front.

To keep the drawers from tilting forward when opened, owing to the low sides, it will be necessary to attach strips of $\frac{5}{8}$ in. stock to the partitions and ends, the lower edges of which will lightly press on the upper edges of the sides of the drawers. These strips should be 15 in. long and about 3 in. wide and fastened with 1 in. wood screws and glue, putting on the glue after locating the position, with two screws, one at each end.

The reader may at first thought reach the conclusion that the work here desribed is of considerable amount and rather difficult, but a careful reading of the directions and study of the illustrations will enable anyone of ordinary skill to make a very serviceable and presentable cabinet, and those having use for one will find the making of it will affect a very considerable saving.

THE METAL WORKING LATHE AND ITS USES.

ROBERT GIBSON GRISWOLD.

VIII. Drilling Accurately on Drill Press.

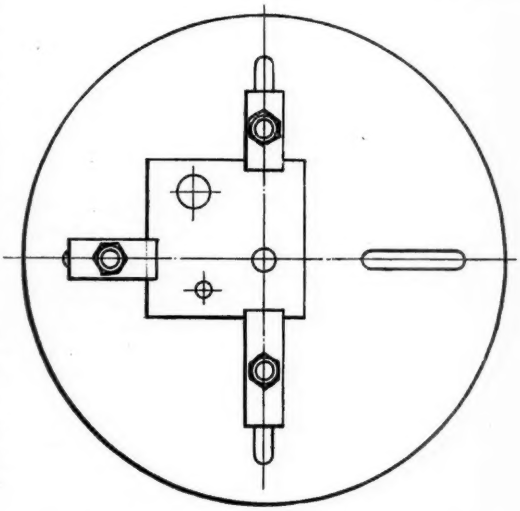
Those who have attempted to drill or bore an accurate hole on a drill press know just what a difficult operation it is. This is due to the fact that, no matter how carefully a hole may have been laid out, to make a twist drill follow a hole true to the mark is next to impossible, owing to the fact that one lip of the drill may cut a little faster than the other, causing it to run. For ordinary work this will do very well when the difference does not exceed a few thousandths of an inch, but if the work is being done it is very essential that the hole be exactly right.

Quite frequently one may see a machine "draw a drill" while starting the hole. When the hole is laid off a smaller concentric circle is drawn inside the first. When the points of the drill enters the material to ascertain depth it is an easy matter to see whether the cone-cup is exactly central with the smaller circle. If it is, the drill is following true, but if not a small groove is cut down the side of the cone on the side farthest from the line, or on the side toward which it is desired to bring the drill to make it coincide with the true center, or the circle denoting the periphery of the hole.

Then when the drill is again started the resistance on this side of the hole is lessened and the drill slips over slightly, cutting more on this side and bringing the hole more nearly in line with the intended center. But the eye is unable to accurately judge when a coincidence between the scribed circle and the edge of the cup occurs, at least within a few thousandths of an inch, and if great accuracy is desired this method cannot be used.

Let as suppose that it is required to drill three holes of different sizes in a die block, as shown in the figure. After finishing the sides of the block until they are truly parallel, coat one (the upper) side with copper upon which the fine marks will show very clearly. This coppering is done in the following manner:

After being sure that the surface is perfectly clean of grease, which may be effected by rubbing it with a rag and chalk, rub it with a rag wet with a solu-



tion of copper sulphate made by dissolving several large crystals of copper sulphate (blue-stone) in a bottle of water to which is added several drops of sulphuric acid. This solution will deposit on the surface of the metal a firm coating of copper upon which the finest lines will appear distinctly.

The holes are then carefully laid off and marked with a very sharp center-pencil. The piece is laid on

the face plate and the clamps adjusted, one of the holes being as nearly central as possible, which may be determined by measuring with a pair of hermaphrodite calipers from the periphery of the face-plate. Before the block is adjusted on the face-plate a sheet of writing paper should be placed beneath it which will give greater friction between the block and plate. The clamps are set up just firm enough to hold the block in place and the face-plate screwed onto the spindle.

Then the center indication mentioned in chapter V, of the January, '05, issue is placed in position with the point of the small or short end in the prick punch mark, and the long end point quite near the tail center. The face-plate is now slowly revolved to quarter turn position, which will indicate in which direction the block must be shifted to bring the center exactly in line with the center line of the lathe. A gentle tap with a hammer will move the block very slightly one way or the other until, when the spindle is rapidly revolved, the long end of the indicator shows no movement but remains stationary. The clamps are now set down firmly and the plate revolved to see that the screwing down of the clamps has not shifted the block slightly.

A centering tool, Fig. 24, page 24, November, '04, issue, is now placed in the tool post and a center carefully bored to start the drill. Then a very carefully sharpened drill of the size required, if a very small hole, is put in position with the point in the center just bored, and the pointed rear end placed in a cup center in the tail-stock. If the drill has a center hole drilled in the rear end, so much the better, as it can then be rested against the tail center. The drill is then gripped firmly with a dog or clamp and the work revolved, feeding the drill meanwhile with the tail-stock feed screws.

If the drill has been properly ground, that is, with both lips exactly even and of the same length, the will bore a true hole exactly where desired. This method, however, may be improved on in holes above ⅜ in., as a small boring tool can then be used. A hole slightly under size is first drilled and finished to exact size with the boring tool, which method is the most positive of any for securing a true hole exactly where designed.

The plate is then shifted to a new position and centered and the next hole bored, and so on. With very careful setting these holes may be bored without a greater variation than half-a-thousandth of an inch or less. If the holes are to be reamed they should be left about .01 in. smaller than finished size and then reamed with the reamer resting against the tail center.

What could be better for a Christmas present than the bound volumes of AMATEUR WORK?

BANKER AND CUSTOMER.

It is sometimes said that a banker to whom a customer has paid in moneys for his current account is a trustee of such moneys, but this is a mistake. The true relation between a banker and customer is that of debtor and creditor only, with an obligation on the part of the banker to discharge the debt in a particular manner. So clearly is this the case that if, after paying money into the hands of a cashier to the credit of his account, which is not overdrawn, the customer should suddenly suspect the solvency of the bank, he cannot withdraw it except by check. In the same way, the moment a bank clerk in cashing a check has placed notes or money in the control of the person presenting the check there is actual delivery and possession, and he cannot take them back. Should a customer overdraw his accouut the bank is not bound to offer the sum really due him, but can rightly refuse to honor the check.

When a check is indorsed the indorsee can bring an action against the drawer, just as the indorsee of a bill can sue the acceptor. A check is not an assignment of any portion of a debt due from a banker to his customer, but simply a request with which the banker has promised to comply. Should the latter fail to meet his engagement to pay, all things being in order, the customer can bring an action against him and although no actual loss has been sustained, will be entitled to nominal damages, as the obligation of a banker to honor his customers' checks rests upon a clear and distinct promise or agreement to that effect, which arises from the course of business and the nature of the transaction. There can be an indorsement in blank or a special indorsement of a check. The post-dating of a check drawn to the bearer, or order, in no wise affects its validity, and a person taking it bona fide and for value has a perfectly good title.

Every banker who honestly pays a check drawn upon himself is entitled to charge the sum he so pays to the account of his customer, although the signature of the payee or indorser has been forged. A banker is bound to know the signature of his customer, and therefore, if he pays a check bearing the latter's forged signature he cannot charge the customer's account with the sum so paid. And if the amount payable on check has been fraudulently altered, the banker who pays it can only recover from his customer the sum for which it was originally drawn. But when there is evidence that the great negligence of the drawer clearly afforded opportunity for the alteration of the check, the customer may have to bear the loss himself if there has been no want of care on the part of the banker in cashing the check.—"Scientific Press."

Every amateur mechanic who wishes to keep posted should regularly read AMATEUR WORK.

ELECTRIC BATTERIES; THEIR CONSTRUCTION AND USES.

FREDERICK A. DRAPER.

IV. The Secondary Cell or Accumulator.

The wide variety of batteries described in the catalogues of electrical supply houses are a source of perplexity to the purchaser who is without technical knowledge or experience to guide him in selecting the kind best adapted for the required service. The ideal kind of battery would be one giving a strong, constant current of high voltage without polarizing, and which would permit of continuous or intermittent use without appreciable internal action when not in use and with a long life.

The accumulator, or storage battery, comes the nearest to meeting these requirements, but the use of such a battery necessitates having a charging outfit, or the sending of the cells out to be charged; the latter being the common but rather expensive custom. The construction of an efficient accumulator was described by W. C. Houghton in the June, 1904, number of AMATEUR WORK, to which are referred any readers desiring to construct such a battery. It will be of interest, however, to consider at this time the action which takes place in a cell of this type, so that we can determine how to properly use the same and discover the cause of any trouble which may occur.

An accumulator or, more properly, a secondary cell, is one in which the fluid would not of itself set up any action between it and the other elements of the cell and so liberate energy; but when energy in the form of an electric current is applied to these elements, the fluid, or a certain portion of it, separates into its constituent gases, the electro-positive uniting with or adhering to the negative element, and the electro-negative with the positive element of the cell, thus creating a difference of potential between the two.

If communication be established between these elements by means of a conductor, but not before, these separated gases will reunite, yielding energy which is returned as electricity to an external circuit, but in the opposite direction. The quantity of electrical current returned does not equal, however, that originally used in the separating or charging process, the extent of the loss depending upon the efficiency of the cell and varying from 10 to 35 per cent.

To obtain an efficient cell of adequate capacity, it is evident that the elements should be those having the utmost affinity for the constituent gases of the fluid so that the operation of charging may be expeditiously done, and the output of the cell be great enough to compensate for the energy used in charging. In determining this efficiency the adaptability of the cell must be considered in relation to its uses as well as the relative cost of the elements used for a given capacity.

To more particularly learn the action of accumulators, we will consider the one described by Mr. Houghton, which is of the "lead" class as distinguished from the other or bimetallic class, the former being in much the greater proportion of those in common use, although the new Edison cell is claimed to have such superior efficiency as will cause it in time to replace all others. This remains to be proven, however, although there is undoubtedly great merit in the new cell, and it will have a large sale when placed generally upon the market.

The Plante lead accumulator, as improved by Faure and others, now consists of metallic lead plates in lattice-work form, firmly filled with lead oxide paste, and contained in a vessel nearly filled with sulphuric acid solution, four parts water and one part acid. The charging of this cell causes the water to become decomposed, the oxygen combines with the paste in the positive plate, changing it to peroxide, and the hydrogen uniting with the paste in the negative plate, changing it to spongy lead. Charging is continued until all the paste has been converted, which is indicated by numerous bubbles rising to the surface, and a milky appearance of the fluid, due to the minute bubbles contained therein. This is termed "gasing", and charging should not be continued beyond the point where this condition becomes pronounced as, while no harm is done the battery, it is simply a loss of current to do so. When charging, the current should flow towards the positive plate.

If, after a cell is charged, the external circuit be completed, the current will flow in the direction opposite that used for charging, the lead peroxide of the positive plate will be reconverted to lead oxide and the spongy lead to lead sulphate in the negative plate. If the discharge rate of the cell has been too rapid or too long continued, lead sulphate is liable to be found at the positive plate, which will be indicated by white crystals and is known as "sulphating." It is an extremely difficult matter to remove, as the crystals are tenacious, and bring more or less of the active material with them when taken off. Being non-conductive, the crystals increase the internal resistance and diminish the output of the cell; they are also very liable to form if the cell is nearly discharged, and then left standing for a long time before again charging. If a cell must be left without use, it should first be fully charged and not allowed to remain too long without action.

The normal voltage of a cell is about 2 volts, rising to nearly 2.5 volts just before charging ceases, and dropping during discharge to 1.85 volts, below which sulphating is very liable to occur. Another injurious effect due to too rapid or long a discharge is that known as "buckling," caused by the formation of minute sulphate crystals between the plate and the lead framework or grid, and causing the latter to expand and distort the shape of the plate. Even under normal use, the plates are liable to expand slightly, and should they from these causes, come into contact with each other, a short circuit will be formed which will cause serious trouble.

Cells of this type are rated at the ampere-hour capacity of their discharge within normal limits, the discharge rate depending upon the size of the plates, and the duration of discharge upon the quantity of active material contained in them and exposed to chemical action. With ordinary construction a normal discharge rate is from 2 to 2.5 amperes per square foot of surface of positive plate, and a discharge capacity of from 4 to 5 ampere-hours per pound of plate, both positive and negative, excluding a suitable allowance for lugs, etc.

As the chemical action taking place during charging and discharging should evenly effect all the active material, the value of a low rate of discharge will be evident, as the action will be more even and longer sustained at normal capacity, and yielding, therefore, higher efficiency.

The life of a cell depends upon the uniformity of its use. Properly charged and discharged it will last for from 1000 to 1500 chargings, with three or four renewals of positive plates. The life will diminish to less than half of the above, however, if discharged at an excessive rate, or too low.

A method of charging a small accumulator by means of gravity batteries is described in the January, 1905 number.

BOOKS RECEIVED.

Experiments in Applied Electricity. Arthur J. Rowland and William B. Creagmile. 181 pp., 8 x 5½ in. 59 illustrations. Cloth. Price $1.50. McGraw Publishing Co., New York.

The purpose of the authors was to produce a manual which would meet the needs of students in technical and manual training schools whose courses of study are engineering in character, but with only a limited time for laboratory work. As this is the condition in all but a few of such schools the arrangement and scope of the book will be thoroughly appreciated.

The wide experience of the authors at the Drexel Institute has enabled them to present the several studies of the principles and laws, together with the most suitable experiments illustrating them, in a most practical way, so that the students shall become familiar with the most approved methods of arranging and handling circuits and connections, as well as the apparatus, which too frequently is lost sight of in works of this character. As the apparatus necessary to the experiments can be obtained at moderate cost, the book will be found of much value by instructors and students who are interested in this work.

The 20th Century Bricklayer's and Mason's Assistant. Fred T. Hodgson. 311 pp. 7½ x 5 in. 200 illustrations. Cloth. Price $1.50. Frederick J. Drake & Co., Chicago, Ill.

Whether amateur or professional, no one can read this book without obtaining much valuable information, as it is exceptionally complete in both text and illustrations. To the rural resident, especially, would it be of value, as by its directions the ability to do the many odd jobs of masonry always necessary around a farm could be readily acquired. On the other hand, the apprentice just starting with his trade would be enabled to make greater progress from this additional knowledge of the principles and practice of his trade. As a book for public libraries it is highly commended.

Modern Locomotive Engineering with Questions. Calvin F. Swingle. 630 pp. 6⅝ x 4⅝ in. 265 illustrations and two folding sheets. Flexible leather. Price, $3.00. Frederick J. Drake & Co., Chicago, Ill.

The locomotive of today is a powerful and complicated machine and the training necessary to become a competent engineer requires careful study as well as ample experience. Why the boiler will not steam or why the piston jambs so the lever cannot be thrown, and the hundred and one other things, even to running a hundred miles on a pint of valve oil, as some railroads are today trying to do, cannot be learned with facility or surety, unless the worker is willing to invest in technical books and study them. Those doing this receive their reward in rapid and sure promotion. The book before us is clearly written, has excellent illustrations and well selected test questions at the end of each section, making it an excellent text book for individual study.

Educational Woodwork. A. C. Horth. 160 pp. 168 illustrations. Cloth. Price $1.00 Spon & Chamberlain, New York.

The object of the book is to provide a brief graduated educational course of woodwork, based on a succession ot joints, with a model following each joint, and as far as possible based on it. To the American reader the use of the old wood plane with wedged iron will seem rather out of date, nevertheless the directions for the several exercises are the clearly given, as well much general information of value.

Renew your subscription before you forget it.

AN EASILY BUILT POWER LAUNCH.

By Courtesy of the Brooks Boat Mfg. Co.

I. Bill of Materials and General Directicns.

The power boat to be described in these chapters will meet the needs of anyone desiring to build a fast, safe boat which shall also be easy of construction by any one without previous experience in boat building. The design of this boat is adapted from the familiar "skip-jack" which sails well. The square sides and nearly flat bottom of this type obviate all steaming of ribs and make the bends of the sheathing very easy to get. About the only objection to this design is, that in a heavy sea the boat will pound and lose headway, but as open boats of this type are not intended for heavy weather this will not be of great importance.

The required materials include:—Of white oak, fir or rock elm: One piece 22 ft. long, 8 in. wide, ⅞ in. thick for keel; one piece 4 ft. long, 16 in. wide, ⅞ in. thick, for transom; one piece 4 ft. long, 7 in. wide, 1⅞ in. thick, for stem and stem-knee; one piece 3 ft. long, 5 in. wide, 2⅝ in. thick for deck-beams and floor-timbers; two pieces 14 ft. long, 6 in. wide, ⅝ in. thick, for sides of coaming.

One piece 8 ft. long, 6 in. wide, ⅝ in. thick, for ends of coaming; ninety running feet, 2 in. wide, ⅞ in. thick, for clamps and bilge stringers; one hundred and forty running feet, ⅝ x ¾, for the ribs; forty-five running ft. of ¾ in. half round for fender-wales; the keel may be spliced, and so made of two shorter pieces, as given on the pattern.

Of pine, cypress, cedar, fir or spruce: Two pieces 20 feet long, 10 in. wide, ⅝ in. thick, for inside bottom plank; two pieces 15 ft. long, 8 in. wide, ⅝ in. thick, for outside bottom plank; two pieces 22 ft. long, 12 in. wide, ⅝ in. thick, for lower side plank; two pieces 22 ft. long 12 in. wide, ⅝ in. thick for upper side plank; two pieces 22 ft. long, 15 in. wide, ⅝ in. thick for middle side plank. The pieces that are 20 and 22 ft. long may each be made of two pieces, spliced. Note that the patterns give these in two pieces, as it is not often possible to get these pieces in this length.

When purchasing the lumber it is not necessary to adhere exactly to the dimensions given in the bill of material, but good judgment should be used in not making any of the parts too light.

For the boat frame we recommend white oak, rock elm or fir in the order named. The first two are good bending timber, and therefore cannot be used for ribs that require a short bend. Southern pine is a very good timber for all parts of a boat excepting for ribs requiring a short bend. It has one objection—that it is very heavy, and for this reason not suited for small, light boats built for speed.

The lumber for the frame should be seasoned. t should be air dried, otherwise it will show checks that detract from the finish and appearance. The lumber for the ribs and coamings that need to be bent should be clear, straight grained and not kiln dried, as this latter method injures its bending qualities.

For planking, pine, cypress, cedar, fir or spruce are most generally used. There are, however, a number

of other timbers that may be used, as any light timber that does not split too easily and will withstand the water is suitable.

In selecting planking lumber, avoid knotty stock. A few sound small knots will do no harm and will make a material saving in the cost. For all kinds of planking, wide lumber cuts to best advantage, for the reason that but few of the plank are straight. For example, you could cut only one plank from a board 10 in. wide, while you might cut two plank from a board 12 in. wide. It is a good plan to get your planking lumber all 12 in. wide or wider, and then arrange the patterns on each board so as to cut it to advantage without excessive waste.

For hardware, get three pounds $1\frac{1}{2}$ in. clout nails for planking sides; three pounds $1\frac{3}{4}$ in. clout nails for planking bottom; two pounds 6 penny casing nails, for fastening lower edge of bottom and for ends of floor timbers; a couple of 10-penny casing nails for the forward end of the clamps; one pound of $1\frac{1}{2}$ in. brads for fastening decks; two dozen 2-in. No. 12 screws, for fastening deck-beams; fifteen dozen $1\frac{1}{2}$ in. No. 12 screws for fastening ribs, floor timbers, etc.; two dozen $1\frac{1}{4}$ in. No. 12 screws for fastening transoms, cleats, etc.; sixteen $\frac{1}{4}$ in. tire or carriage bolts, $2\frac{1}{2}$ in. long, for fastening the keel splice; two $\frac{1}{4}$ in. tire or carriage bolts, $7\frac{1}{2}$ in. long, for fastening the stem to stem-knee; one $\frac{1}{4}$ in. tire or carriage bolt, 5 in. long, and one $3\frac{1}{2}$ in. long for fastening stem-knee to the keel; four $\frac{1}{4}$ in. carriage or tire bolts, 4 in. long, for fastening the transom-knee. Sandpaper, putty and paint. If boat is to be used in salt water, use brass bolts and copper nails.

The nails, screws and bolts may be of black iron, galvanized iron or copper nails and brass bolts. For fresh water boats, black iron fastenings are just as good as either of the others, and much cheaper. For salt water, however, you should either use copper nails and brass or bronze screws and bolts, or have all of galvanized iron. Do not mix galvanized iron fastenings with brass or copper in the same boat, as these metals, together with salt water, set up an electrical action that tends to destroy both.

A good putty for filling seams and covering nail heads is made of equal parts of white lead and whiting. The addition of a little Japan drier will cause it to harden quickly.

A good white lead paint is made by mixing equal parts of white lead and zinc, with equal parts of boiled oil and turpentine. For finishing in natural wood, only the best spar varnish should be used.

For tools, a claw hammer, clinch iron, rip saw, smooth plane, block plane, screw driver, one-half inch chisel, three iron clamp-screws of five inch opening, plumb bob and line, two saw horses about 20 inches high, bit stock, No. 4 German bit, $\frac{1}{4}$ inch bit and a countersink for bitstock will be needed.

Before driving a nail, always first bore a hole with a bit slightly smaller than the nail. In building most boats you will use two kinds of nails—the common or wire nail and the clout nail. This latter is a cut nail with a small point so that it may be driven through and clinched. When boring for a wire nail make the hole about two thirds the length of the nail. When boring for a clout nail, bore clear through the parts to be fastened. A clinch iron must be held against or opposite all clout nails when they are driven or set, and it should be held against the common nails when possible.

A clinch iron is any piece of metal offering a surface against which the nails will clinch; a common flat iron makes a very good clinch iron. Clout nails should clinch about $\frac{1}{8}$ of an inch longer than the parts to be fastened.

Before driving a screw, always first bore for the screw with a bit 1-16 of an inch smaller than the shank of the screw. Always countersink for the head of the screw. For a No. 12 screw use a No. 6 German bit. For a No. 10 screw use a No. 4 German bit.

The bill of materials calls for three kinds of bolts—carriage, tire and drift bolts. A carriage bolt is the common bolt used by all wood workers. It has a round head and a square nut. A washer should always be out under the nut. The tire bolt is the same as the carriage, excepting that it has a round, flat head, the same as a screw. A washer should always be put under the nut. Tire bolts are often substituted for carriage bolts when galvanized or brass bolts are being used, for the reason that they are much cheaper. Drift bolts are seldom called for. They are used to fasten heavy pieces of oak, such as a pipe-log and keel of a launch.

A drift bolt is simply a rod cut off to the length required. In cutting drift bolts the cold chisel will swell or swedge the edges where cut. This would cause the bolt to cut its way into the auger hole and enlarge the hole so that the body of the bolt would not be firmly held by the timber; therefore before driving a drift bolt hammer down the point so that it is slightly smaller than the rest of the bolt, thus causing it to wedge into and not cut its way into the auger hole. Bore holes for all drift bolts with an auger 1-16 of an inch smaller than the bolt. Drift bolts are usually driven through a washer. The driving in of the bolt upsets the end and forms a head that may be hammered down on top of the washer. Wood screws are sometimes substituted for drift bolts. These have a coarse thread nearly the whole length, and a square head so that a wrench may be used to screw them into place.

The construction directions will begin in the next chapter.

Red sealing wax is made of pure bleached lac, to which, when melted, are added Venice turpentine and vermilion. Inferior grades are made of common rosin and red lead. Black and other colors are obtained by adding proper pigments. Sealing wax was known in the seventeenth century.

PHOTOGRAPHY.

PHOTOGRAPHIC POST CARDS.

C. F. POTTER, JR.

The making of photographic post cards is a feature of camera work that does not seem to be receiving as much attention by amateurs in this country, as has been the rule abroad.

I do not believe we appreciate just what the illustrated post card means until we get away from home on a trip of some kind, especially if it takes us to a foreign land.

It is when the camera man gets away from home on an extended trip that he turns to the sensitized post card as the best means of keeping his friends and home folks posted as regards his whereabouts and affording them glimpses of what he and his camera are seeing.

Cards of the developing or "gas-light" variety will be found most convenient for the amateur en tour, and almost any room can, in the evening, be used for this work. The thorough-going amateur will, of course, develop the films as he goes along, and not trust to bringing back the whole lot for development after the trip is ended. The chances for deterioration seem to be greater after the light action has taken place, and one is liable to find the numbers on the black paper neatly printed off on the film, always, of course, in a prominent part of a negative.

The printing of post cards offers no especial features different from ordinary printing, except as regards the use of masks or cut out forms of paper, and the necessity necessity of having a printing-frame of ample size in which to work and get any desired arrangement of mask and negative. I find an 8 x 10 frame with a glass in it, none too large for post card work from 4 x 6 negatives.

The usual form leaves a space for writing, either at the end or bottom or both. The only mask needed for these would be an "L" shaped one, with the long side narrow and the short side wider. Circles and other other forms may be used if desired for sake of variety.

A broad expanse of bare foreground may be included in printing the card, and utilized for the writing space, this, of course, when the negative is larger than the post card dimensions. The usual size is three and three-eighths. Similarly, a blank expanse of sky could form the writing space, though in such a case it would be better to place the card lower down on the negative, leaving out most of the sky and using a mask to secure the writing space at the bottom of card.

It will be apparent to all that the printing of post cards from large negatives, where all of the negative is to be included, can be accomplished as in slide making, or the reverse of bromide enlarging. We might call it bromide reducing.

Our English cousins who go into these things "all over" and who have a larger number of manufacturers catering to their wants than we do here, have a special copying camera for post card reduction from large negatives, fitted with a special card holder on the same principle as a plate holder. They use either the ordinary developing paper cards, or fast bromide cards; the latter being preferable because much quicker.

There are several other processes adapted to post card work and the prepared cards can now be had in a printing-out matte paper and in platinotype, the latter certainly being the method de lux, though perhaps more liable to damage in the mails.

The ordinary government cards can be used and coated with various sensitizing solutions if one cares to attempt this work, but let me warn you against coating them with blue-print solution if you care anything about your reputation. The cards are of cream or yellow tint and no matter how well the blue print is done you cannot get rid of the yellowish high-lights, looking exactly as if the chemicals had not been properly washed out of your print, and the tones don't "jibe" worth a cent.

Kallitype or any of the processes giving brown tones can be used to excellent advantage, and by coating just the space you wish to print upon, with a solid center coating and lightly coated edges, you can get a vignetted effect in the print. The cream tone of the card harmonizes with the brown print, and, indeed you can find no better example of this pleasing combination than the Sepia paper which is also furnished in post card size with the usual inscriptions on the address side.

We can refer readers who wish to coat their own card to Kallitype and other processes, or they may get the Photo-Miniature booklet on that subject, and also on Plain-Paper Printing. A ready prepared sensitizer called "Etchine" is on the market and well known and I can speak very highly of it from personal experience.

Many of our readers will find themselves so located as to make a commercial use of the picture post card craze, as for instance: an acquaintance of mine who lived near a large summer resort and did developing and printing for the visitors. Ordinarily the one print of each subject would be all he would get to do, and he decided to show some of his customers how nice their pictures would look on sepia post cards. Selecting some of their best films in the next batch he developed, he made prints on the cards and found the idea was a winner. Many of the visiting "snap-shot" had not heard of the post cards, but when they saw

how nicely they could remember the friends at home without much trouble on their part (the summer resort visitor is not looking for trouble) and at a slight expense, my friend soon found that he had all he could do to supply the demand.

The collecting of picture post cards has become quite a fad, and among photographers there are now several "exchanges" or clubs who exchange cards, limiting their selections to photographic cards of their own make exclusively. Such a club is a branch of the International Photographic Fxchange, a most healthy organization conducted by Mr. F. S. Clute of San Francisco, and a membership in it would bring any of our readers into communication with numerous good workers in this country and abroad. The mission of the post card seems to be that of showing the main points of interest attaching to the place from which they are mailed, rather than reproducing merely artistic or miscellaneous subjects.

A rather recent ruling of the Post Office Department, requires that all the cancelling on a postal card of any kind be done on the address side. This was a measure adopted to prevent the disfiguring of the illustrated cards, and we are sorry to see that some persons have not been content to use the post card privilege for the purposes originally intended, but have overstepped the bounds of propriety in printing pictures on mailing cards that are of such a character as to debar them from the mails. We trust such abuse can be dealt with in a fitting manner and that they will not result in a rescinding of the whole picture post card privilege.

Properly conducted, the exchanging of illustrated cards may be made both interesting and educational to a large degree, and to that end the cards should represent some feature of natural, historical, architectural or other interest peculiar to the place from which they are mailed, or present local types of the people and their modes of living, etc.

Those of our readers who have obtained some insight into the dollars and cents side of the work, will not be slow to recognize the many opportunities afforded in their local fields for the exploitation of the post card idea. A suggestion or two may not be amiss. Your local hotel keeps a supply of stationery for the free use of its guests. Make a better negative of the hotel than the cut they use, print it on the sensitized post card, show it to the proprietor and explain how a half-tone reproduction could be made and cards printed to supplement the office stationery. Tell him how the cards would often be used for short notes, taking the place of paper and envelopes and making a saving in that way for him. How each card mailed would carry with it a fine view of the hotel, advertising it all over the country at the expense of his guests who pay the postage.

Perhaps your town boasts a department store with a writing room for the accommodation of shoppers. Here the same idea might be put into effect and cards illustrated with views of the various interior and exterior features of the building.

In handling such orders you will, of course, first have gotten figures from engraver and printer for getting the cards printed and half-tone "blocks" made from your prints so you will be in a position to quote prices.

If the book and news stores of your city do not already carry a line of post cards illustrating the principal points of interest in and about your locality, you will find a large opening awaiting your endeavors, with a fair promise of ample returns for the work providing you have the knack of selecting the most favorable points of view and making better photographs than "the other fellow."—"Western Camera Notes."

PHOTOGRAPHIC NOTES.

Many amateurs are perplexed when their prints sometimes appear lighter in the center than at the edges; these effects are often caused by pouring the developer on to the center of the plate, instead of flooding the whole surface evenly and quickly with the solution When using rapid-action developers it is most essential to cover the whole of the plate almost simultaneously. To do this, take the dish in the left hand and the measure containing the solution in the right. Then, slightly tilting the dish away from you, run the measure quickly along the edge of the dish, at the same time emptying the solution over the plate.

Never add alum to the fixing solution. Where it is necessary, either for plates or paper, it should be employed either before or after fixing, with sufficient washing between.

"If I had a bright boy whom I wished to see get along in the world and make a lot of money," said an engineer to the "Canadian Manufacturer," "I would enter him in the new profession of automobile engineering. He should begin as a chaffeur—not to be a light headed speed rivaler and law breaker, but that he might learn to operate a machine well; that he might learn how to operate all sorts of machines. Then he should enter a factory and learn how to make them. Possessed of this knowledge I would have him serve a term on the road as salesman, introducing the machines. After that it would be his business to find a good location and set up for himself as dealer and agent. It is the coming business and there will be a lot of money made in it by men who know how."

The silver coinage of the United States contains 900 parts silver and 100 parts copper, while that of Great Britain contains 925 parts silver and 75 parts copper.

THE STEAM TURBINE.

Abstract of a Paper by F. C. Gasche presented before the Steel Works Club of Joliet, Ill.

In contradistinction to the reciprocating engine, the fundamental principle of the steam turbine lies in the fact that the reciprocating engine does work by reason of the static expansive force of the steam acting behind a piston, while in the case of the turbine the work is developed by the kinetic energy of the particles of steam, which are given a high velocity by the pressure to a lower. Steam turbines may be divided into two classes: Reaction turbines of which Hero's is an example; impact turbines, of which Branca's is an example; a combination of the two.

General principles applying to the design of steam turbines are the same as made use of in water turbines. The buckets and guides must have as little skin friction as possible and be so arranged that the steam may strike without sudden shock and have its direction of motion changed without sharp angular deflections.

One great difficulty that presents itself is the tremendous velocity of steam as compared with that of water under ordinary heads. In the reaction or Hero type turbine the peripheral velocity must be equal to that of the jet of steam to give us the ideal condition and in the impact turbine the ideal condition is when the peripheral velocity of the buckets is one-half that of the steam jet.

With high-pressure steam discharging into a vacuum the velocities obtained are from 3000 to 5000 ft. a second. A turbine built on the lines just given would, therefore, have peripheral velocities far beyond the limits of strength of material. As an example, a 19-inch Hero engine would revolve at 75,000 revolutions a minute, and the ends of the arms carrying the steam nozzles would have a velocity of over 40 miles a minute. The great problem confronting the inventors of steam turbines has been to reduce this velocity and at the same time to utilize the maximum amount of the energy of the steam.

Several attempts have been made to improve the simple reaction turbine of Hero and produce one that will run at a slower speed. In 1862 Charles Monson patented a turbine having a succession of simple reaction wheels, each one in a separate chamber and arranged so that steam issuing from a wheel into its chamber passes through the hollow shaft into the next wheel and so on; Fig. 1 gives the idea of this invention. Steam enters the hollow arms in chamber *A* through the hollow shaft, passes out through the orifice at the end into the chamber *A*, whence it is conducted to the hollow arms in the chamber *B* through a second passage in the shaft, and so on to the last chamber.

In 1885 C. A. Parsons secured his first patent for a compound reaction turbine. In all his work the inventor, who was the first to place the steam turbine in large units on a commercial basis, has adhered to the reaction type and is responsible for the successful development of the compound reaction motor. At one time or another Parsons has patented most of the feasible arrangements for the compound turbine, until, at the present time, the Parsons turbine manufactured by the Westinghouse Machine Co., is one of the most successful in the world. Fig. 2 shows the first Parsons turbine patented in 1885. Steam enters at the center *A* and passes to right and left between the series of guide vanes attached to the outer casing and the rotating blades attached to the inner drum which rotates on shaft *BB*. The steam escapes through the exhaust pipe *E*.

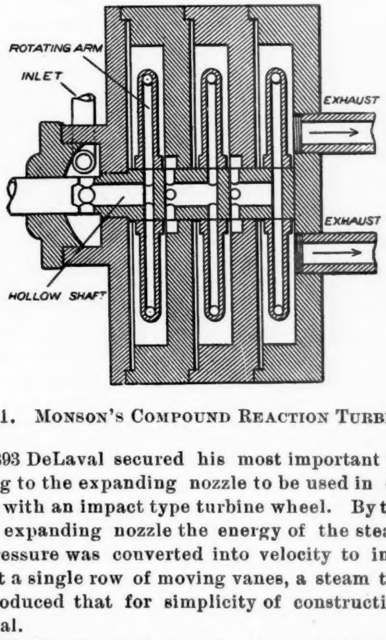


FIG. 1. MONSON'S COMPOUND REACTION TURBINE.

In 1893 DeLaval secured his most important patent relating to the expanding nozzle to be used in combination with an impact type turbine wheel. By the use of this expanding nozzle the energy of the steam under pressure was converted into velocity to impinge against a single row of moving vanes, a steam turbine was produced that for simplicity of construction has no equal.

In 1800 Mr. Curtis designed a steam turbine which was a combination of the DeLaval and the Parsons. A steam nozzle, which is a modified form of the DeLaval, is employed to expand the steam and give it a high velocity before it comes in contact with the blades, but a certain amount of expansion is left to take place in passing through the alternate rows of stationary and rotating vanes as in the Parsons.

Of the DeLaval turbine the unique features are the nozzle and the means by which the wheel is enabled to revolve upon its axis of gravity. DeLaval mounts

his wheel nearer the center of a long light shaft capable of being bent and returning to its original form. The shaft is mounted upon bearings of ordinary construction. This flexibility enables the forces set up by the revolving wheel to deflect so as to let the former revolve about its axis of gravity.

In the divergent nozzle the whole expansion of the steam is carried out. The steam at the mouth of the nozzle has the same pressure as the exhaust. In other words the steam has its energy completely transformed into mass and velocity by the time it comes into contact with the buckets. This brings up another feature of this turbine, and that is that no parts with the exception of the nozzles, are subject to steam pressure.

With 150 pounds steam pressure and 26 in. vacuum the velocity of the steam leaving the nozzle is 3810 feet a second or 43 miles a minute. The nozzles are set at an angle of 20° to the plane of motion of the buckets so that the theoretical velocity of the buckets should be 47 per cent of the velocity of the steam, or 1790 feet a second or 20 miles a minute. It has been found difficult to produce a material for the wheels that with an ample margin of safety would withstand the strain produced by the centrifugal force at this high speed, hence it has been necessary to reduce the speed not to exceed 1350 feet a second.

With the peripheral speed of the buckets set at 1350 feet a second, the diameter of the turbine wheel will determine the number of revolutions a minute which in small machines is as high as 30,000, and in larger machines 10,000 to 20,000 revolutions. To reduce this high speed of rotation within practical limits a pair of helical spur gears are used, giving a reduction of 10 to 1. These form by far the biggest part of the entire outfit. The necessity of using gears to reduce the speed from 10,000 to 30,000 down to 1000 to 3000 revolutions limits the size of the DeLaval turbine to 500 horsepower.

To avoid the use of gears Dr. Riedler and Prof. Stumpf have designed a wheel which is in successful operation in Germany that is essentially the same as the DeLaval except that the diameter of the turbine wheel is made ten times as large, thereby reducing the number of revolutions to one-tenth while keeping the peripheral velocity the same.

With this slower speed is also avoided the necessity for the flexible shaft. These machines have been built up to 2000 horsepower with a wheel 10 feet in diameter and running at 3000 revolutions a minute, and it is proposed to build a 5000 horsepower turbine with a wheel 16½ feet in diameter and running at 1600 revolutions a minute.

In the impact type turbine when using saturated or wet steam, there is considerable wear on the blades owing to the tremendous velocity of the steam, but in the Parsons type turbine this wear is almost entirely avoided on account of the low velocity of the steam which seldom exceeds 400 feet a second as compared with 1350 feet a second in the impact type. Thi low velocity of the steam is obtained by use of the large number of rows of vanes through which the expansion takes place.

In the 300 horsepower turbine there are 70 rows of vanes so that, in expanding steam from 150 pounds pressure to 26 in. vacuum, the drop in pressure between any two adjacent rows is only 2¼ pounds, which will produce a velocity of about 380 feet in a second, for the steam or proper peripheral velocity of the bucket of 180 feet a second. With this low peripheral velocity there is no trouble in getting the speed of rotation down to 3000 revolutions a minute, or less if desired.

In the Curtis turbine steam is allowed to expand in a nozzle similar to DeLaval's until it has a velocity of 2000 feet per second and this velocity is then reduced by compounding through six rows of moving vanes additional expansion taking place while passing through these rows of vanes as in the Parsons. By this means, the peripheral velocity, which amounts to 1320 feet a second in the DeLaval and 200 feet a second in the Parsons, is brought down to 400 feet a second. The diameter of the turbine wheel is then made four times as great as the Parsons, following the plan of Reidel and Stumpf, which gives a velocity of rotation only one-half that of the Persons.

In spite of the fact that the steam turbine eliminates the two largest sources of loss in the reciprocating engine—initial condensation and friction,—its economy has not come up to the high standard expected on account of leakage past the vanes due to the clearance that is necessary to prevent the revolving vanes striking the stationary ones with difference in expansion of the two when heated, and the unknown losses due to the friction of the steam at high velocity in the expansion nozzle or in passing through the thousands of small passages. The actual steam economy which the builders will guarantee is just about the same as that guaranteed by the makers of the best types of compound engines.

Cost of attendance in favor of the turbine, as one man can care for more of the larger units than can two men where the reciprocating engine is used. Cost of maintenance is bound to be less with the steam turbine on account of its greater simplicity and freedom from a multitude of moving parts. The item of lubricating oil is almost entirely eliminated in the turbine and the only parts subject to wear and breakage are the vanes which are easily replaced.

If the question of space is vital, the steam turbine requires only three-fourths as much floor space as the vertical engine and only two-fifths as much as the horizontal engine. As you can install 4000 horsepower of steam turbines in the same building that would be required for 1000 horsepower of reciprocating engines, and this with only one-half the head room, you have one of the most important considerations in the designing and building of a power station in our large

cities, or increasing the output from one already built.

With the steam turbine are avoided all vibration and shock due to the inertia of the reciprocating parts. The weight of the reciprocating parts of a 500-horsepower engine is about 30,000 pounds, with the engine running at 100 revolutions a minute and having a 5-foot stroke, this immense weight must be brought from rest to a speed of 1600 feet a minute and then slowed down again to rest and stopped 200 times every minute; it is evident, therefore, what an advantage the turbine has in the matter of foundation necessary to hold it. As to relative first cost, the question is hard to determine, because it is quite as difficult to compare the costs of the turbine and piston engines as it is to compare the costs of different engines. At the present time, the cost of a turbine and generator installation is about the same as for a piston engine and generator installation of the same capacity.

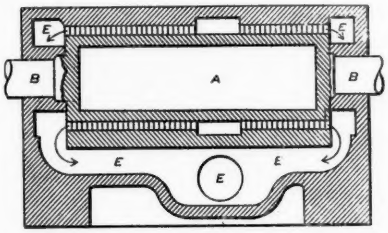


FIG. 2. FIRST FORM OF PARSON'S TURBINE.

Running of direct connected, alternating-current generators in parallel has come to be a frequent requirement, but frequent as it is, its accomplishment has been anything but an exact science. But no difficulty exists with the steam turbine, as there is no fluctuation of angular velocity, but one direction of motion and no element to detract from an even turning moment. Due to its speed, more flywheel effect is stored up than is present in the piston engine, so that steam turbines easily run together in parallel as hydraulic engines always have done.

It is now quite generally recognized that superheated steam has an advantage, although there is still much to be learned about it. Future investigations, however, in which the turbine will take an important part, will reveal more precisely its economic status, and it may be hoped that before long the net advantages to be derived from different high steam temperatures will be known. The turbine may be used unreservedly with superheat of any feasible temperature. It has no internal rubbing surfaces and there are no glands or packings to become injured; as no cylinder oil is required, there is no opportunity for lubricating troubles; furthermore, there seems to be rather more proportionate benefit from superheat with the turbine than with the piston engine because of diminished skin friction.

In every essential aspect of its commercial utility the steam turbine appears to stand on solid ground. It has its field chiefly in electric lighting and power stations, although in small sizes it has been extensively used for driving blowers, pumps and other devices; its speed, of course, prohibits belt or rope driving, but the direct connected electrical generating unit has been the aim of modern power development.

COST OF CARRYING THE MAIL.

"Harper's Weekly" produces the following information on this subject:

The United States pays the railroads, for carrying mail about $41,000,000 per annum. This sum is further increased to $46,000,000 with rental of mail cars included. In France, the railroads, in return for their grants of right of way, carry the mail free. The only exception is where the government uses a postal car of its own; then the railroad receives about a cent a mile, almost nothing, for hauling government cars. In Switzerland, prior to government ownership, the railroads received nothing; their concession from the government provided that the railroad company should carry the mails free. An exception was made where the company earned less than three and a half per cent dividend per annum. In Germany the railroads haul one mail car free. Where a second or more cars are needed, the government pays the company, if a government car, five pfenning per axle per kilometer, or ten pfenning if the the car belongs to the railroad company. This amounts to from eight to twelve cents a car per mile, representing barely the cost of hauling the cars. In Austria the same regulations prevail as in Germany, except hauling extra cars average from ten to fifteen cents per mile. Italy pays nothing to the railroads for carrying the mails, as it is provided in the concessions made to transportation companies that the government mails must be carried free. Belgiums laws are similar to those of Italy. In England, even with the immense volume of parcels carried by the British government, instead of, as in this country, by express companies, the money received by the railroads for carrying the mails is only about one-ninth of the amount paid by the United States.

Rubber boots are, at best, hot things for Summer wear, yet the farmer must either wear waterproof shoes or go with wet feet much of the time. An exchange gives the following recipe for waterproofing to apply to shoe leather: One pint boiled linseed oil, one half-pound fresh mutton suet, six ounces clean yellow beeswax, four ounces yellow rosin. Melt the ingredients and mix well. Apply when warm, but not hot, and rub into the leather. This recipe is said to be used by New England fishermen with perfect satisfaction. They often stand for hours in water without damp feet.

AMATEUR WORK.

DRAPER PUBLISHING CO., Publishers,

88 Broad St., Room 522, Boston, Mass.

A Monthly Magazine of the Useful Arts and Sciences. Published on the first of each month for the benefit and instruction of the amateur worker.

Subscription rates for the United States, Canada, Mexico, Cuba, Porto Rico, $1.00 per year.

Single copies of back numbers, 10 cents each.

TO ADVERTISERS.

New advertisments, or changes, intended for a particular issue, must be received at this office on or before the 10th. of the previous month.

Entered at the Post Office, Boston, as second class mail matter, Jan. 14, 1902.

DECEMBER, 1905.

A Commission of Technical Education was appointed early in the present year by the Governor of Massachusetts to investigate the subject of technical education and report to the next General Court. Without attempting in any way to forestall the report of this commission, it can be stated that at the several hearings which were held, much evidence was given of the value of such schools, but more especially that class of schools which give evening instruction. Some doubt was shown relative to the success of a general system of technical day schools unless such schools were to replace, in part at least, the time given at present by pupils in the regular high schools. The value of the present manual training schools was strongly emphasized, but it was also plainly shown that much still remains to be done in the way of further development before attempting to add educational methods which would be even more expensive in operation than any at the present supported by muncipalities.

It was the general opinion, however, that a system of technical evening schools utilizing as far as possible the equipment of manual training schools, would be of great value to the many young men in the community who have come to realize the, value of such training but who neglected to obtain it during their younger years. Young men as a rule do not appreciate, until too late, the advantages to be obtained by becoming skilled in some trade or craft, and it is not until they have had a few years of business life that they realize their lost opportunities. To this class trade schools with evening sessions would be invaluable and the earnestness which would accompany their studies would make progress rapid and thorough, a condition which does not maintain with those of younger age. To amateurs, also, such schools would be of value, enabling them to perfect themselves in some line of work which, though followed for pleasure, would have many practical advantages.

There is but little doubt that such schools are sure to be instituted in time, and the report of this commission will be awaited with much interest, as it will undoubtedly be the basis for action not only in Massachusetts, but in many other States.

The work of forming the "American Society of Model Makers" is being pushed as rapidly as possible, and we are pleased to state that the number of letters received showing interest in the society is more than large enough to indicate an active and growing society. The membership will at first be general, and local branches started whenever a sufficient number in any one locality have signified their desire for such a branch. The work of organization will undoubtedly be completed so that full particulars can be given in the January number.

Many useful tools may be obtained by securing new subscriptions for AMATEUR WORK.

THE WIMSHURST MACHINE AND X-RAY WORK.

T. E. ESKIN.

II. Useful Accessories and Methods of Using.

We will now, before we go any further, look at the Wimshurst itself and give some account of the results of small improvements that have been made. First of all we look at the conductors. In the third machine brass was discarded and magnalium was substituted. As far as I am aware, magnalium had never before been used for this purpose. In passing it may be said that magnalium is an alloy of aluminum and mangesium, and strange to say, is lighter than aluminum. It is a better conductor than brass. It takes a high polish, especially I have found with paraffine, and when once polished practically does not tarnish. It is very easily worked and is not expensive. It is a most useful metal.

The conductors consist of two magnalium tubes 1 3-16" in. diameter, and from these magnalium rods project carrying points to collect the electricity from the plates. There are, of course, brass balls at each end of the collectors. The jars consist of four gas jars. These are very convenient, having a length of 10 in., a diameter of 2 in., and a glass bottom of 3 in. They were mounted on sheet ebonite, and after being covered for 2 in. with tinfoil, strips of India rubber were glued over the bottoms and on to the ebonite, thus holding them firm. A wood plug inside covered with tinfoil carries a magnalium rod, which is so screwed into the conductors. The ebonite is mounted on a piece of wood, and this is made to slide in or out. This is of great use, as if anything goes wrong with the belts, the conductors can be instantly removed from the stand, and the belt at fault easily got at.

Next, we may say a word about the brushes. These are generally made fixed, but we prefer two frames movable upon the axis that carries the plates. Although the machine develops the greatest power when the brushes are placed at "five minutes to five," yet when separated so that the frames are at right angles to each other the sparks are more frequent. Sometimes it happens that the machine does not readily sensitise; then moving the frames apart brings it on at once. We have made a simple arrangement by which the frames are maintained in any position. Two small pieces of wood, *AA*, are fixed by screws into the two frames; the two pieces join together at *B* where is a stout pin, which projects into a slot, *SS*. By means of two small nuts placed on each side of the pin at *B*, the frames can be clamped in any position. See Fig I.

The Brushes.—Unless these are always in contact with the plates, there is great loss of power. To insure this the following arrangement has been made: *A* and *B*, Fig 2, are two thin pieces of wood. A band of leather unites them at *C* and forms a hinge. A piece of thin brass wire is rolled round a pen, and thus made into a light spring, which is inserted at *SS*. The brushes are inserted at *D* and *D* through holes drilled in the wood, and connected up by two wires to the frame wire at *C*. By this arrangement the brushes

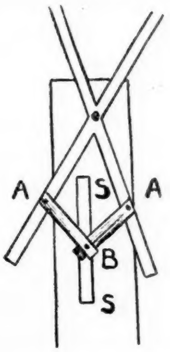


FIG. 1.

are always kept in close contact with the plates. For the single plates a thin piece of wood projects from the frame towards the plate, and on this is mounted a similar spring *S*, Fig. 2, the end of which is straight, and passes through a ring at *L* and, projecting outside carries the brush. It will be obvious that this in like manner is always pressed firmly but lightly against the plate.

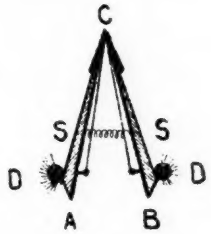


FIG. 2.

A few general hints as to working may be useful. Dust and damp are the two great enemies to effective working. The removal of the first is a comparatively easy matter. A short stick round which a piece of soft rag is wrapped can be held between the plates while they are slowly turned. It is well from time to time

also to clean the unsectored sides of the plates. The tinfoil sectors become black with use. We have substituted thin sectors of magnalium well polished; these can easily be cleaned from time to time as required with a little paraffine on a rag. But there is considerable difficulty in mounting them, and so they are liable to leak. We have tried capping them with small half-moon shaped pieces of ebonite, but with very doubtful results. Probably it will be possible to obtain some magnalium foil in time, when the difficulty of mounting will be overcome.

FIG. 3.

Getting the machine damp is a much more serious catastrophe, and at a thousand feet above the sea, with sudden changes of temperature and variable hydroscopic conditions, is almost unavoidable. It occasionally happens, in a sudden change from cold to warmth, that dew is precipitated on every piece of metal or glass in the house. The machine, though always kept covered up when not in use, naturally suffers. It rarely fails to sensitize, but there is no output, and if the room be now darkened a curious state of things is revealed. On each side, half the conductor is receiving positive, and the other half negative electricity. So that although the machine is alive with generated electricity, yet from the positive and negative being thus mixed up the output is nil. The only thing to do now is to go mathematically to work. Don't try moving near the fire, for fear of the plates warping—a disaster which once occurred with a small machine. By the bye, it may be useful to add that the plate thus warped was successfully straightened by placing it between two warmed iron plates from the oven and putting weights upon it. Get warm cloths and go over all the plates. Warm the glass jars and rub them well with a warm cloth. A hot brick placed under the plates is sometimes successful, but the plates should be kept turning. The flame of a spirit-lamp passed rapidly backwards and forwards underneath the rotating plates sometimes answers well. When once it is seen that all the collectors give brushes on one side, and points on the other in the darkened room, there is little probability of there being further trouble. Under the atmospheric conditions we have mentioned the machine is very liable to reverse, and the plates are best kept very slowly turning till the commencement of the work in hand.

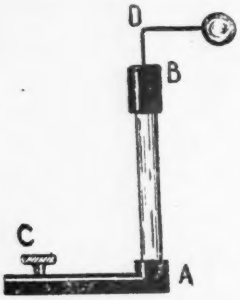


FIG 4.

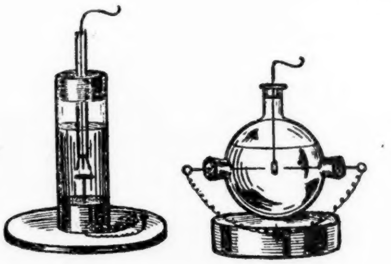
We now come to the question of spark-gaps, and at the very outset one may say that each tube requires different treatment. Sometimes it has been advised to place the balls as near as possible to the tube. This in highly inconvenient, as they are constantly in the way; and further, one never feels quite sure that the tube is not endangered. An arrangement that was in use for some time and answered well, consisted of two pieces of glass tubing about one foot long. These were fixed into two pieces of wood, which were grooved at the sides and fitted to work on a slide. The balls, which were of course mounted on the glass, could easily be made to approach or recede at pleasure. Finally the following arrangement was made, and gives more satisfaction than any other yet tried: *AB* Fig. 4, is a stout glass pillar 13½ in. long by 1½ in. diameter. One end is fixed into a strong piece of wood 7 in. by 4½ in., through this passes a clamp *C* which holds it firmly in any position. The other end of the glass pillar is let into a piece of wood at *B*, and from this a stout magnalium rod *D* springs, which carries the ball. This piece of apparatus is so mounted that the ball is level with the ball of the machine conductor. The wires to the tube can be put on or taken off the rod *D* in a moment, while by releasing *C* the whole can be moved out of the way, or the length of the spark-gap varied on either side as is desired.

As regards the size of the balls, experiment will alone decide. We have balls from ⅝ in. up to 3½ in. in diameter. In the case of some tubes the brilliancy is vastly enhanced by the use of large balls. In the next place, we must say a word about connecting up with the tube. The thickness of the wire does not seem to be of much consequence; only if too thick, it will no longer be flexible. It should be passed through indiarubber tubing; but the connecting-up with the tube requires care. Usually with a bianodic tube a fine spiral of wire connects the two anodes. This is best removed. A fine piece of indiarubber tubing, about 8 in. long should be taken, and a wire passed through it; at each end there should be a second piece of tubing sufficiently large in diameter to pass over the glass projection which carries each anode. The ends of the wire should now be connected with the two anodes, and the second piece of indiarubber slipped over them. The tighter the indiarubber tubings fit over each other the better, and the outer one may be turned back over the inner till the wire is fixed, and then it can be passed over the anode by turning it straight again. We

now take the middle of our tubing, connecting the anodes, and make a small hole, and insert the wire connecting with the spark-gap. The junction of the wires should also be protected with a larger piece of tubing to cover it up. By these means the brush discharge from the end of the tube will be greatly diminished if not entirely done away with. Having now described all the different pieces of apparatus, we come to the actual working of the whole. This falls into two divisions (1) with primary circuit alone, (2) with primary and secondary circuit.

Primary Circuit.—Here the bottom of the jars are unconnected, and the tube is excited by the current directly from the conductors. The current from the Wimshurst is, however, feeble, and the larger the number of plates the better. The output depends on the speed of rotation of the plates. In fact, the brilliancy of tube equals numbers of plates, multiplied by the speed of rotation. The brilliancy is also affected by the spark-gap. If this is too large, the tube shows signs of reversal, particularly if a small-sized one; if too small, the glow is faint. One spark-gap of ½ in., or two of ¼ in. generally work the best.

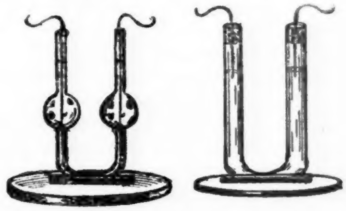
With primary and secondary circuit.—If the bottoms of the jars be joined together, the brilliancy of the tube is, as we should expect, doubled; but as the charge is intermittent, the tube is unsteady and smart sparks occur from time to time which are apt to be disastrous. Leyden jars added still further increase the brilliancy of the tube, but, of course, increase its unsteadiness. For various experiments a large number of jars are



FIGS. 5 AND 6.

made, and we have two four-pint jars, eight gallon jars, two still larger, and one five-gallon jar. The last is affectionately named "Jumbo," and has a table to himself, and is treated with due respect, since, having been left in the room during one evening's work, though quite away from the machine, he somehow acquired a charge, and when he was touched promptly deposited one of us on the floor. This is said as a word of caution, as it is by no means pleasant to be "knocked into the middle of next week." Experiments with the secondary soon led to some interesting results. Passing the current from the outsides through a large coil of fine wire gave very bright but intermittent flashes. A series of experiments were then made with various forms of resistances, some of which may be described.

Fig. 5 is a glass tube, 6 x 2 in., securely corked and having a small disc of magnalium mounted on a wire carried through the bottom, and outside to a terminal. Through the top passes a piece of glass tubing with a cork at the end, which is pierced with four pins. A copper wire passes down the tube and is connected to the four pins with a drop of mercury. The outer glass tube is filled with oil. The inner tube can be moved up or down till sparks pass freely between the points and the disc. This answers and gives good results.



FIGS. 7 AND 8.

Fig, 6 is a three-necked retort receiver, also partially filled with oil. Two rods pass through the horizontal corks, and are connected together by wires to a terminal on the stand. The vertical neck has a rod which ends in a magnalium disc. It was thought that as the tube was bianodic the resistance should be as well. It cannot be said that there was any improvement on the original one.

Fig. 7 is a convenient shape and consists of a chloride of calcium tube. The bend is filled with mercury, which extends just up to the bulb. The rest of the tube is filled with oil. The two wire pass through corks at the ends of the tubes, and spark on the mercury. Many other forms and modifications of these were tried with varying results. Generally, the more sparking points there were the better. The principle is the same in all,—viz., a sparking resistance.

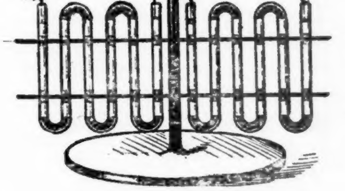


FIG. 9.

Fig. 8 is a resistance of another kind, and gives much superior results. It is a U-tube 8 in. long by ⅞ in., and the liquid used is a solution of copper sulphate. Into this two copper wires plunge. Of course any acid solution will do equally well.

The last form is shown in Fig. 9. This consists of twelve pieces of glass tubing, each 1 ft. long, connected

together with indiarubber and containing solution of copper sulphate. The mounting is an upright piece of wood carrying two glass rods, and to these the tubes are fixed. A small coil of fine wire, not shown in the figure, is also interposed, and with the spark-gap properly adjusted, the tube is brilliant and steady, and seldom troubled with sparks. The resistance in the secondary act as a balance to the resistance of the primary, which is made up of the tube and the spark-gaps. If the spark-gap is too small the secondary cannot pass, and the tube is as if running from the primary only, and if too large there are sparks at the tube instead of current in the secondary. When the two circuits are properly balanced the brilliancy of the tube is most extraordinary, and the larger the diameter of the tube the better the result. One word of caution—don't leave a resistance coupled up at one end only, otherwise it will blow up with an alarming explosion and scatter the liquid contents in all directions. The results of our experiments are communicated in hopes that they will be useful to others.

HOTHOUSE CULTIVATION OF FRUITS.

Consul-General Roosevelt, writing from Brussels, tells of the development of the hothouse-grape industry and the extension of hothouse cultivation to other fruits and vegetables. He reports:

About forty years ago the cultivation of grapes under glass was practiced on a small scale at Hoeylaert, a village near Brussels, more as an experimental venture than as a business enterprise. From the beginning the experiment was accompanied by success, and from its small origin this method of cultivation rapidly developed until it now ranks as one of the most flourishing and lucrative industries in this district. Today there are no less than 10,000 hothouses in the immediate vicinity of Brussels.

The hothouses are usually from 65 to 82 feet in length, and about 26 feet in width. Heat is distributed through clay pipes.

The principal varieties of grapes are: Frankenthal, a blue, medium-size grape of fine flavor and very juicy; Big Colman, an immense purple grape of attractive appearance, somewhat too solid and lacking in juice, and the Black Alicante and Queen Victoria, both acceptable as to quality and flavor. These grapes are sold on Belgian retail markets all the year round, at prices varying with the seasons from 15 cents to $1 per pound. In the last few years the cultivation of peaches in connection with grapes, has also become quite profitable, and though still practiced on a limited scale, has produced excellent results, the yield being first class in every respect.

The cultivation of strawberries, tomatoes, spinach, lettuce, asparagus and chicory under glass is also carried on in this district by syndicates, which regulate production as well as prices. Grapes grown in this consular district are exported largely to England, Germany, Russia and Denmark, and occasionally in small quantities to the United States.

TIME DISTRIBUTION BY TELEPHONE.

The Observatory of the Bureau of Longitudes of Paris, says the "Electrical Review," is adopting a new method of time distribution by telephone. It is intended to be used in regulating chronometers and clocks throughout the city, in watchmaking and scientific establishments, and no doubt it will be of considerable value. At the Observatory a standard clock has a michrophone placed inside of the case, which receives the shock caused by the clockwork. The microphone is connected to the city telephone circuit, and thus a subscriber can receive the time regulation in order to adjust his chronometers or clocks. This can easily be done by counting the beats, and the exact time corresponding to the first beat is given by the voice through the telephone. It will be noted that the microphone is operated simply by the mechanical shock, and there is no direct electrical connection attached to the clock. Even the slightest electric contact made by the clock might have an effect upon its movement and thus put it out of order, especially in the case of a standard clock which has to be regulated within one one-thousandth of a second. With the use of the microphone, no such errors could be introduced. The method could also be used for astronomical work between two observatories, which by noting the beat could be made to work together by means of a single clock.

At Klagenfurt, in Austro-Hungary, the electric process of pipe-thawing is used somewhat extensively by the inhabitants. The winters in this region are very severe and the pipes are often frozen. The Hubner-Messimer electric firm adopted a system which has proven very successful says the "Electrical Review." A fifty-ampere transformer is installed in a convenient place near the electric lines and it is connected by two fuses to an ammeter which measures the current consumed and a rheostat. The wires from the secondary of the transformer are run to two points on the pipe which is to be thawed out. A pipe 150 feet long and half an inch in diameter can be thawed in three hours using a current of 50 amperes and 110 volts.

An interesting source of power is found at St. Pierre, S. D., where the city has decided to put in an incandescent electric light plant to be driven by waste water from the artesian wells. Tests have shown that water, coming under pressure, will develop more than enough power to operate such a plant.

A CHEAP NINE-INCH REFLECTOR.

M. A. AINSLEY.

VII. Continued Testing of Lenses.

Before passing on to describe the tube and mounting I employed, I must say something as to the procedure in case of over-correction. If the polisher is made as I suggest, and the pitch is not too soft, over-correction, *i. e.*, class C^3, is not likely to occur until the final figuring is in progress; but when the polisher is graduated, a few minutes polishing makes a great difference to the figure, and it is only too easy to overdo the deepening of the center, and so get the hyperboloid. In such a case it is sufficient to make a new polisher of uniform squares and polish with short strokes. The pitch may also be a little harder with advantage. I found, in working my first 9 in. mirror, that it was quite impossible, with uniform facets, to advance beyond the oblate spheriod, class A, and it was not until I graduated the polisher that I could even get a spherical figure, much less anything like a paraboloid. The mirror, however, was very light, being only 1 in. thick. In the case of the second 9 in. mirror, which is 2½ in. thick, the same thing occurred, the figure showing no signs of altering beyond class A until the polisher was graduated. I think, therefore, that the method I have indicated is fairly safe.

The Tube.—I describe the one made for my second 9 in. mirror, as that used for the first, though fairly satisfactory, proved rather liable to warp and split. My tube is built up of ½ in. mahogany screwed to four corner-pieces of teak 1½ in. square, which extends the whole length. This gives a very stiff tube, which, at the same time, is not too heavy to be removed from its stand and carried indoors, or, at least, under shelter. The tube is 10 in. inside measurement, though I think 10½ in. would be better. The length, of course, depends on the focal length of the mirror; in my case it was 73 in. If the tube is made about 3 in. longer than this focal length it will about do.

Drawings of the tube will show, I think, how it was all fitted up. Fig. 1 is partly a section, partly a view, of the left side of the tube. Fig. 2, a view of the front and Fig. 3 of the mirror end.

AA are the corner pieces of 1½ in. teak, to which are screwed *BB*, the sides of the tube of ½ in. mahogany, an opening being left at *C* to enable the mirror to be covered by a hinged lid.

M is the speculum, supported by two small brass pieces *D*, on the backing *E*, which is circular, and

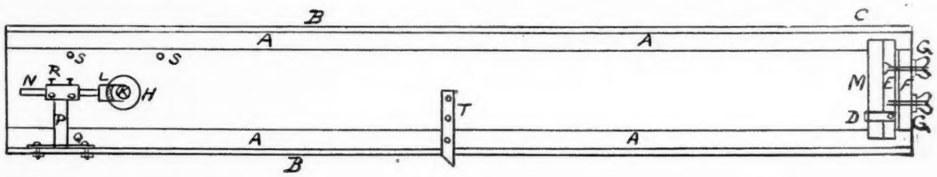


FIG. 1.

made of 1 in. teak, covered with two thicknesses of cloth.

F is the end piece of the tube; also of 1 in. teak to which the long corner pieces *A* are screwed. The mirror is adjusted by three long brass bolts *G*, the heads of which are sunk flush with the front of *E*. These have adjusting nuts outside, while the mirror board *E* is pressed forward by a central pad of india-rubber, shown to the right of the letter *E* in the figure. This keeps the screw just taut without bending the board *E*; the bolts *G* pass through board and end of tube quite loosely.

H is a hole 2½ in. or so in diameter, the position of which on the side of the tube is decided by the focal length, and by the distance outside the tube at which we desire the image to be formed. If, for example, we want the image 5 in. outside the tube, then the distance from center of tube to image=5÷5=10½, and the center of *H* must be (focal length—10½ in.) from the

In case of pronounced over-correction, *i. e.*, when the curve is distinctly B,—I think it is best to regrind with, say, one-minute emery, or Dr. Blacklock's method might be adopted. He made a doubly graduated polisher, the central squares being reduced in size as well as those at the margin; while on a zone about half-way between center and margin the facets were kept the same size as before. I have not tried this method, so cannot speak from experience; but I think I should be rather afraid of rings making their appearance on the mirror. In making my second 9 in. mirror I obtained very slight over-correction at the finish; but a new polisher of hard pitch and uniform squares corrected this in ten minutes or so.

One more word about testing. It is very necessary to have behind the mirror, which is transparent, being unsilvered, a uniformly dark surface; otherwise false lights and shadows will show, and confuse the tests. I used black paper; but anything fairly dark will do.

surface of *M*. Through the hole can be seen the flat mirror *K*. This is 1½ in. in minor axis--1¾ would be better—and is supported on a cylinder of teak *L*, cut off at 45°, to which it is clipped by copper strips. This block *L* is held at the end of a ⅜ in. brass rod about 8 in. long, which passes quite loosely through a short brass tube *O*, 3 in. by ¾ in. the rod *N* being held at two points by means of six screws, *R*. This gives almost unlimited power of adjustment in any direction. The tube *O* is held on a pillar of iron *P*, 1 in. broad by ¼ in. thick, which is securely fixed to a plate *Q*, 6 x 3 x ¼ in., which is secured to the side of the tube by four small bolts. I am aware that this is not the orthodox way of mounting the flat mirror; but, after trying the ordinary way in which three springs are employed, I have adopted the method shown, as it is far easier to make, to fit, and to adjust, besides being absolutely firm. As regards the definition, or rather the loss of definition, produced by the pillar *P*, I have not found anything to complain of after careful comparative trials.

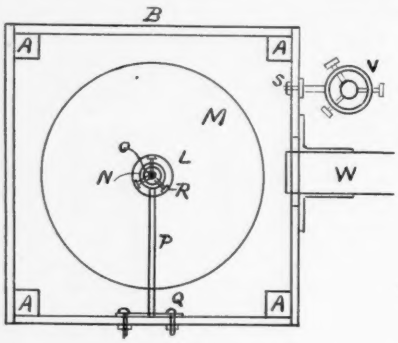


FIG. 2.

At the sides of the tube are pointed pieces *TT*, 9 x 1 x ¼ in., which take its weight when on the stand. *SS* are ½ in. holes drilled in the side of the tube to take the fittings for carrying the finder. These are shown in Fig. 2.

I have made no provision for covering either of the mirrors, as I found that if care is taken to prevent violent changes of temperature the silver film is little affected by time. So long as the whole tube is kept clear of dust and protected from direct impact of rain, the mirrors do not dew over, and I have found the films on them last well over a year without renewal. The silvering process I have adopted is so quick and simple that resilvering is virtually no trouble. A cover for the end of the tube, which is stowed in a vertical position in a porch or under an open shed, is all I have been using.

The fittings to carry the eyepiece I have not drawn. Almost anything will do in the way of rackwork, such as the front of an old magic lantern, or the mount of an old portrait or other photographic lens. A visit to an optician will most likely furnish what is needful for a few shillings. Even rackwork is not absolutely essential, and I have found that a simple sliding tube about 5 or 6 in. long (Fig 2, *W*) with a screw thread to take the standard eyepiece screw, and sliding in another tube about 2 in. long, with a flange by which it can be fixed over the hole *H* (which need not be of any particular size) is practically quite sufficient. If the tube is made to slide easily, and kept lubricated with vaseline and protected from blows, which would dent it, focussing is just as easy as rackwork after a little practice. This tube is of course also used in the testing apparatus before mentioned. It will also be convenient to have a disc of brass with a hole about 1-16 in. in diameter in the center, to screw into the end of the tube in place of an eyepiece for the purpose of adjustment, as will be described later.

For merely testing the mirror on a star, a stout board, not less than 1½ in. thick, to which the flat mounting, etc., can be attached, would be sufficient, but as I said before, I recommend that tube and mounting be made as soon as the focal length is accurately known—certainly as soon as the polish is coming up. In this way we may take advantage of any fine weather that may occur for testing on a star and after all, the image of a star is the "final court of appeal" as regards the perfection, or otherwise, of the mirror.

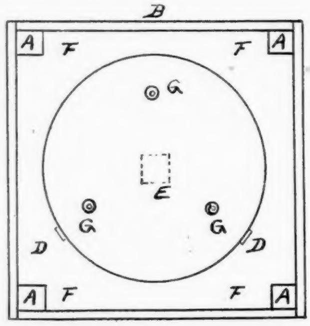


FIG. 3.

For purposes of testing, the mounting may be very simple. I have found that an ordinary kitchen chair balanced on its hind legs and carrying the tube across the back and seat, makes an efficient temporary mounting if steadied in some way by cords, struts, etc., or the telescope may have its mirror end on the ground and the front end on a trestle; in fact, a number of ways in which the telescope can be kept pointing to the Pole Star will occur to the reader, and the Pole Star is the best for the purpose on account of its brightness and its very slow motion in the field of view.

The finder is carried on two iron rings with stems passing through the holes *S* and secured by nuts inside. Each ring, as shown in Fig. 2 at *V*, has three screws, similar, but larger than those used for securing

the flat, and with this arrangement adjustment is easy and quick. A finder with cross wires complete, may be picked up second-hand, or an ordinary cheap telescope, such as is sold for $1.25 or so, can be utilized. If the second or third lenses, counting from the object-glass, be removed, the telescope becomes an inverting one of lower power, and if the small tube containing the two lenses nearest to the eye be drawn out, a diaphragm will be found be placed across this, and secured, as nearly as possible at right angles and crossing in the center, by means of seccotine, an efficient finder will be provided—not that a properly constructed telescope with the necessary adjustments is not better. In any case, the provision of an efficient finder will be a great help in the testing.

In my next I will describe the method of adjusting mirrors and finder, and the mounting I have employed.

DIRECTED WIRELESS TELEGRAPHY.

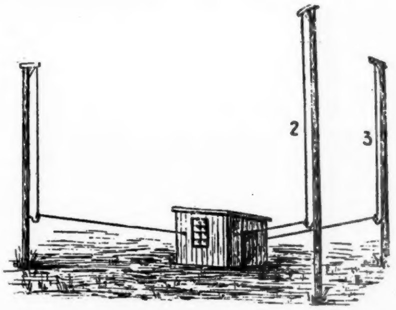
Early in July some experiments were conducted at Strasburg by Dr. Ferdinand Braun with a system of directed wireless telegraphy which he has invented. The results seem to him very promising, for he was able at will to direct the waves so as to actuate the receiver at the receiving station or not. Dr. Braun in several German journals discusses his experiments and points out the probable usefulness of his developments.

Since electric waves are governed by the same laws as light waves, it should be possible to throw a beam in one direction by means of a parabolic reflector, but the practical difficulties in the way seem to be insuperable. It occurred to Dr. Braun, however, that he could construct a system of sending wires which could be made to intensify the wave in one direction and interfere with it in another. If two sending wires are tuned to exactly the same pitch and are operated by the same exciting apparatus, but are so arranged that one of them will be set in vibration a small fraction of a second later than the other, it should be possible to obtain interference. The difficulties encountered in doing this are those of tuning two oscillators to the same pitch, and of producing the desired difference in phase.

New methods had to be devised for measuring these exceedingly small time differences. This has been done, but the method is not described. Extended laboratory experiments resulted in the development of means of tuning the wires and for producing the difference in phase sought without throwing the two wires out of tune. In this work Dr. Braun was assisted by Dr. Papalexi, of the Strasburg Institute, and Dr. Mandelstam, who co-operated with him.

The laboratory results agreeing satisfactorily with the theory, it remained to test the system on a practical scale. Fortunately a suitable place for carrying out this work on a larger scale was available in the large drill ground at Strasburg, known as the Polygon which was courteously tendered to the experimenters by the military authorities. The investigations were carried out on a small scale as compared with wireless telegraph transmission systems, since it was desirable to obtain quantitative, and not merely qualitative, results. It was intended to measure the difference in intensity of the waves sent out in different directions, and for this purpose a relatively short transmission was advantageous.

The sending station consisted of three wooden masts arranged at the corners of an equilateral triangle. Upon each of these masts was stretched a wire or antenna, from the lower point, of which a connecting wire was carried to wooden building placed at the center of the triangle, in which are mounted the various sending devices. A sketch of the arrangement is given in the accompanying figure. By means of the apparatus contained in the building it was possible o set the wires on posts 1 and 2 into synchronous vibration, and to set up a vibration of the wire on post 3 of the same pitch, but which lagged or led in phase the vibrations of the other two. Assuming the vibration of wire 3 to be slightly lagging, interference between it and that of wires 1 and 2 would take place in the direction from 3 over the house at right angles



RECEIVING STATION.

to the plane containing posts 1 and 2. This amounts to throwing an electrical shadow in that direction. If, on the other hand, the vibrations of wire 3 were made to lead those of 1 and 2 by a proper amount, an amplified wave would be sent out in the same direction, and a shadow thrown backward from wire 3 and, at the same time, interference on the sides would take place. In carrying out this work it was necessary to obtain great accuracy in timing the vibrations of the three wires. The time differences was about one ten-mil-

lionth part of a second. Dr. Braun concludes from his work that it is possible to adjust the time difference to within a two-hundred-millionth part of a second. This amounts to an accuracy of one second in six years.

This system of three masts is only a simple arrangement, for more sending wires might be used with an augmented effect; but for the work in hand the simplicity of the system presented some important advantages. It should be noted that transmission is not limited to one direction only with three masts, for it can be sent in the reverse direction by reversing the phase relations. By alternating the function of wire 3 with that of wires 1 and 2 it is possible to transmit messages at will in six directions. The simple addition of a commutating switch in the sending station enables this change in direction to be made easily and at will. It was found that the receiving apparatus at a particular position responded without fail when this commutating switch was in one pesition, and yet showed no signs when the position of the switch was changed. The distance of the sending station was in these researches 1.3 kilometers.

The results of the experiments were completely in accord with the laboratory investigation and with theory. In other words, it is possible by means of this arrangement to direct a wireless message through a fairly narrow angle. Dispersion takes place and is not small, but there is a decided electrical shadow in the reverse direction, and there is, in fact, a wide angle in which no effect can be measured.

If the receiving station had been equipped for transmitting messages also, it would have had three or more antennæ, and there is no doubt that these wires could be used in an analagous way for increasing the effect at that point.

The use of more than three wires would enable the transmission to be sent out through a still smaller angle with a less degree of dispersion; but it would complicate the system somewhat. The system as it is, with the three wires, is considerably more complicated than that having but a single wire, and the question is raised whether a parabolic reflector consisting of a number of wires properly arranged might not be employed with but a single oscillating wire at the focus. This is shown to be impracticable, since to be of any value with waves of the length of 120 meters, which is comparatively short, and therefore relatively favorable for this purpose—the sending wire should be about thirty meters from the reflector, and the latter should have an opening of 120 meters at the focus. Moreover, this reflector should be extended many hundred meters at the sides in order to prevent dispersion. A reflecting wire placed at this distance from the sending wire occupies a very small angle, and hence would be almost useless as a reflector.

It was found that the three wires, as used in the interference system, had no effect whatever as a reflector. Although there is no fundamental reason why this difficulty should not be overcome, there is the other objection that the parabolic reflector should be about a kilometer long to give results comparable with those obtained with the three-wire system described.

The Strasburg tests, in Dr. Braun's opinion, demonstrate that a directed system of wireless telegraphy is practicable. Five wires might be substituted, which would increase the action in one direction and give rise to less dispersion, but the three-wire system gives results as favorable as could be expected.—"Electrical Review."

The following is a simple method of removing what is commonly called damps from a well which may be of interest, says James I. Bennett, in the "Engineer." I had charge of a plant where we had a deep well, which was dug down 75 feet, then drilled some 200 feet further. The water end of the pump was down in the dug part of the well where the drilled hole commenced. The steam end was above ground and a rod connecting the two was stayed to a timber set vertically in the well. It was necessary to go down into the well every time the pump was packed. For some reason or other it was impossible to get a lantern to burn at a depth greater than 3 feet below the surface. I tried everything I could think of, but it was no use. Finally I tried the plan of forcing air to the bottom of the well by attaching a 2-inch hose to the fan of a small portable forge and lowering one end of the hose to the bottom of the well. I found that I had mastered the difficulty and always felt safe when down in the well, with some one at the fan forcing fresh air to the bottom.

German papers state that the "Great Grocery Exhibition," an association of large dealers in groceries in England, has now for the fifth time offered a prize for a safety lamp using mineral oil. A lamp is wanted which shall not cost more than 50 cents and which, regardless of any ignorance or carelessness, must not be more dangerous than a common candle. The problem seems to be hard to solve, as a prize has already been offered four times heretofore. Many lamps have, of course, been received for competition, but so far none has satisfied the judges. That such a lamp would be of great value is apparent from the fact that during last year no less than 256 fires, about 5 each week, in the London district were due to petroleum lamps.

Silver can be rolled into sheets 1-1000 of an inch in thickness, and silver foil is made so thin that it will transmit light.

INEXPENSIVE WIRELESS RELAY.

ARTHUR H. BELL.

Amateurs desiring a sensitive relay for their wireless receiver at moderate cost, have been unable to find anything in the open market cheaper than the 150 ohm telegraph relay of general commercial use.

This relay costs in the vicinity of $7 and is not exactly suitable for use in the coherer circuit because of its sluggishness. Polarized telegraph relays of high resistance winding are not carried in stock by supply houses, and the cost of a special one, built to order, would be over $15. Thus it is that the amateur, searching the apparatus field for a satisfactory combination of electro magnet and permanent magnet with which to make a relay, happens across a very common telephone part—the polarized bell or polarized ringer, as it is often styled.

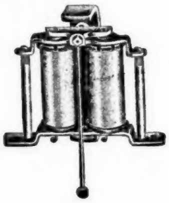


FIG. 1.

As will be seen by the illustration, Fig. 1, the polarized ringer has two electro-magnet coils, wound with very fine wire. The resistance of the wire often reaches 1000 ohms to the coil, making 2000 ohms to to the pair. In fact, there are standards of resistance for these windings, namely, 80, 500, 1000, 1500, 2500 ohms per set. The purpose of these ringers is patent to all who have read previous articles in this magazine on telephone systems, and as all reliable telephone instruments are equipped with them, every reader will have an opportunity to observe their operation in actual telephone usage.

For our purpose, however, the value of a ringer in the telephone field will not be considered. Any manufacturer of coils and telephone parts can supply these either with or without the two gongs, for less than $4, the price depending upon the resistance and quality of the winding and the general finish of the parts.

It will be noted that there is an armature pivoted over the pole pieces of the magnets, and a permanent steel magnet with one pole fastened to the yoke of the electro-magnets and the other pole an inch above the armature. Because of this permanent magnet the ringer is polarized and the armature kept in stress and acting very inert when the coils are energized. For example, a dry cell of battery connected to the coil terminals will cause the armature to tilt in a direction according to the direction the current is sent through the windings.

Here, therefore, is a simple polarized relay, readily adaptable to wireless service by connecting the coil wires to the binding posts for the coherer circuit, and placing a contact point on the bell hammer rod and a contact post on the baseboard with which to make contact when the armature swings over. The connections are exactly as with the familiar telegraph relay.

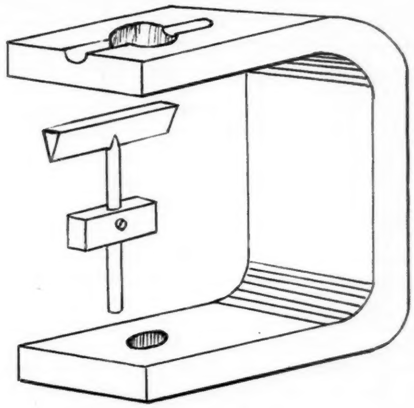


FIG. 2.

It must be understood, however, that the pivots of these $4 ringers were not calculated for the exceedingly sensitive work of wireless telegraphy, and all the parts of the ringer are not adaptable to our purpose. The bell coils and the yoke bar to which they are fastened should be kept intact. The armature and hammer and the pivot supports should be removed. The steel magnet is neither long enough nor high enough above the coils. It will be found useful some day for experimental purposes and should not be thrown away.

Another magnet of steel (Jessops) out of $\frac{1}{8}$ x $\frac{3}{8}$ stock should be forged into horse-shoe shape, with poles the same distance apart as on the magnet removed. A hole should be drilled at each end, one for fastening to the coil yoke, and the other to support a set of bearings for the armature. The piece should then be magnetized. Fig. 2 shows the general shape of this magnet.

In selecting style of bearings the knife edge is undoubtedly the easiest to make, and fully as efficient as ordinary jewels. The sketch in Fig. 2 will illustrate how the bearings of this relay are formed on the top of the magnet, which is polished with a fine file, a niche

cut with the same and smoothed on an oil stone. The armature and the supporting rod must be of soft and very thin, light pieces of iron.

Out of the bell armature which was removed, must be fashioned two pieces, as in Fig. 3, to be adjustably fastened with machine screws to the poles of the electro magnets. In use these pole pieces are just far enough apart for the armature to swing in between.

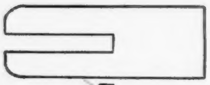


Fig. 3.

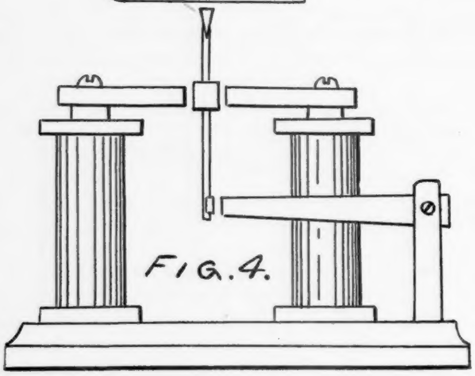


Fig. 4.

The maker may use his own judgment as to the best method of connecting a contact point to this armature, the facilities for doing this being different in each individual case, but one way in which this can be done is to solder a point of platinum to the lower end of the pivoted pendulum, which contact strikes against another contact spring attached to a wooden or metal pillar post, which is affixed to the base-board near the magnet coils. (See Fig. 4.) It will be noted in Fig. 4 that when the armature swings over and a contact is made, that a complete circuit is made through the sounder.

A TROUSERS STRETCHER.

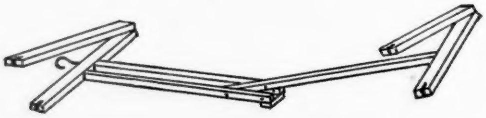
WILLIAM C. KENDALL.

The writer has tried many different patterns of trousers stretchers, but for convenience in applying or removing, as well as simplicity of manufacture, has found nothing which compares with that to be described. It has been used with marked approval of parents, that is, the fathers, as an exercise in woodworking for pupils in a manual training school, and may, for that reason be found of interest by both instructors and pupils in similar schools.

To use this stretcher the trousers are fastened near the top in the wide clamp, and near the bottom of the legs in the other clamp, the arm carrying the latter being raised several inches wheh applying. The stretcher is then turned over and the arms pressed down into line and the fastening pin put in place, thus holding the trousers at a firm tension. A hook on the wide clamp is for hanging on a clothes hook. Care must be taken not to leave snap matches in the fob pocket, otherwise the result may be surprising and disastrous.

The clamping ends are made from strips $1\frac{1}{2}$ x $\frac{3}{4}$ in.; the long clamps are 15 in. long, the short ones are 10 in. long. The arms are 22 in. long, $1\frac{1}{4}$ in. wide and $\frac{5}{8}$ in. thick, and are mortised to the clamps. The section with two arms has the outer ends of these arms fastened together with a piece $3\frac{5}{8}$ in. long, two brass screws in each end being used.

The single arm passes between the two arms of the other section a distance of 8 in., a pin joint being placed 1 in. from the end of the single arm and 7 in. from the end of the double ones. This is made by boring a 3-16 in. hole through all three arms and then driving in a piece of round brass rod $4\frac{1}{2}$ in. in length. Holes are also bored through all three arms $1\frac{1}{2}$ in. from the ends of the double arms, these holes being a loose fit for a brass pin 3-16 in. diameter and $4\frac{1}{2}$ in. long.



This pin is to be removable and a very satisfactory head for the same can be made from the round screw nut found on dry cells, the pin being filed down to a drive fit, or threaded, if the latter can be done conveniently. A brass screw hook is put through the fixed arm of the wide clamp.

The clamps are held together upon the trousers by brass bolts with thumb nuts. These bolts are slipped into slots cut in the free ends of the clamps. As the bolts are liable to be lost, a better way is to use thumb screws and put pins through, the slots being made to allow free turning. It will probably be necessary to file the heads flat, as they flare out somewhat where they join the screw portion. Brass hinges with three screws in each leaf are used for the clamps, and are so attached as to leave about $\frac{1}{4}$ in. space between each arm of the clamps.

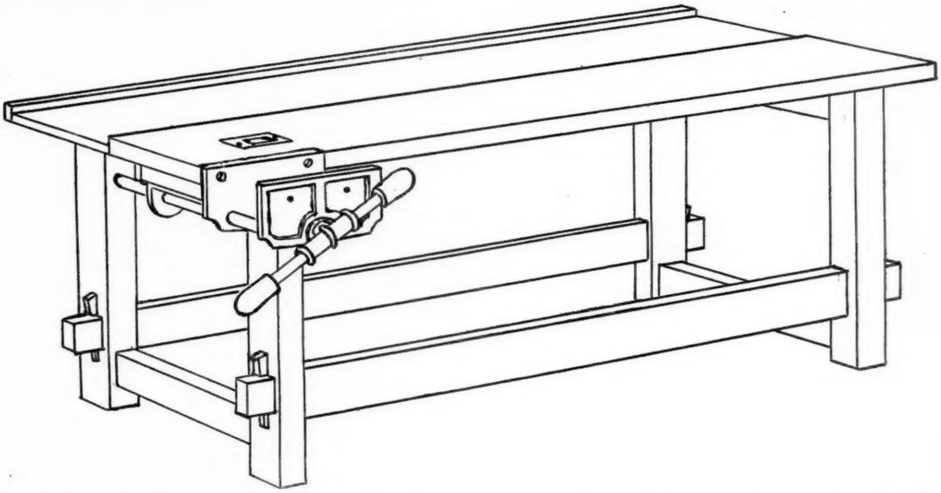
Mahogany is the wood usually selected for making the clamps, and with the brass trimmings makes an attractive appearance, but any light, strong wood will serve. Oak is rather too heavy.

For leather belts castor oil not only stops slipping, but gives the belt twice as long a life.

A WORK BENCH.

JOHN F. ADAMS.

A good work bench is a great aid in turning out work, greater accuracy being secured as well as greater rapidity, yet how many, especially amateurs, are to be found working at some makeshift contrivance of old boards, not because they cannot afford the amount required for stock for making a bench, but rather that they have never realized the value of one in their work. To readers of this class let me say, let no time be lost in ordering the necessary stock and making a bench according to these directions, as I am sure that the increased facilities afforded by such a bench will be sufficiently appreciated to win the thanks of those acting upon this suggestion.



If funds be limited, spruce can be used and will make a strong bench, but care must be used not to mar it by heavy pounding or cutting with metal tools. Maple will increase the cost, but is a fine wood to wear under heavy duty, although no bench should be used as an anvil or to stop cuts with a chisel or bit. The illustration shows a bench fitted with a quick acting vise, a fixture well worth having if one can afford the $5 necessary to secure it. Where economy is necessary an ordinary carpenter's vise can be substituted, the iron screw for the same costing about 60 cents.

The lumber bill is as follows; 1 plank 6 ft. long, 12 in. wide and 1¾ in. thick; 1 board 6 ft. long, 12 in wide and ⅞ in. thick; 1 strip 6 ft. long, 1¾ in. wide and ⅞ in. thick, for the top. For legs, 4 pieces 3 x 4 in. stock 32 in. long which, planed on all sides, will be ⅛ in. less each way. For the long braces 2 pieces 2 x 4 in. stock, 5 ft. 6 in. long, and for the short braces, top and bottom, 4 pieces 2 x 4 in. stock. 18 in. long.

Tenons are cut on the short braces 2¾ in. long and 3 x 1¼ in. Mortises are cut in the posts for same to bring the top ones flush with the top of the posts, and the top edges of the lower ones 7 in. from the floor. The tenons on the long braces are 4 in. long and 3 x 1½ in., the mortises for same in the posts being located to clear those for the cross braces by 1 in. After these are fitted, mark out and cut holes in the tenons to receive wedges 5 in. long, ½ in. thick and ⅞-⅝ in. wide. The object of using wedges is to give increased rigidity. All joints should be laid out with a marking gauge and carefully cut to exact fits. Poor joints mean a rickety bench.

When the frame work for the legs is completed, the front (2 in.) plank is attached by large wood or small lag screws put up through the top braces, boring 1 in. holes 3 in. deep and then continuing with a gimlet bit of the size to give a snug fit to the screws. Use three screws at each end. This plank projects forward 2 in. beyond the front of the posts. Next, attach the ⅞ in. board in the same way, using care that the two pieces are closed up to leave no crack between them.

Another way of fastening the frame is to use 3 in. angle irons, eight being necessary. The strip at the back is then attached by wood screws, the top edge of this piece to be the same height as that of the front plank, so that work placed across the two will lie level.

If preferred a wide board with racks along the top

for tools may be substituted, but the writer prefers to keep his tools in cabinets where dust and moisture will not injure them. A bench stop is also to be fitted to the left end of the bench about 6 in. from the end of the bench and 3 in. from the front edge. Get the kind with hand nut for adjusting to height, instead of the kind requiring the use of a screwdriver.

Another very useful attachment not shown in the illustration is an arrangement for planing boards of various widths and lengths. A board about 22 in. long, 8 in. wide and 11-16 in. thick will be needed. Also 4 strips 4 ft. long and ½ in. square. Two of these are fastened to the edges of the front brace at the right end, leaving a ¾ in. space between for the board above mentioned. The remaining two are fastened to the under side of the front plank directly over those below, thus forming channels in which the board slips freely. The board is slipped in from the left end after boring ¾ in. holes at distances from the top of the bench varying by 1 in., but in 4 vertical lines, so that the holes will not be too near together. A plug is placed in the appropriate hole, upon which the work is rested.

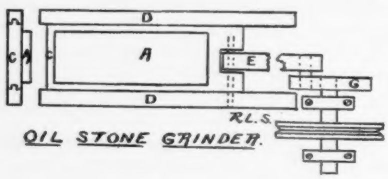
Another valuable feature is a cabinet of drawers for tools, there being ample room for one with drawers 36 in. long and 12 in. wide; having two drawers 3 in. deep, one 4 in. and one 7 in. deep, with the necessary space of ¾ in. between them, and ¾ in. top and bottom. Such a cabinet should be supported by two braces between the long ones of the bench, and located at the extreme right end. It should be made as a separate fixture to facilitate removal when moving the bench about.

A TOOL GRINDER.

RAY L. SOUTHWORTH.

A device that has proved to be very useful and practical, also a formidable rival of the grindstone or emery wheel when these are not available, is shown in the drawing.

An emery stone, preferably a coarse one, is mounted on a movable piece, and a tool holder may hold the tool upon the stone, as the latter is moved to and fro,



or the tool or piece to be ground may be held by the hands. A spring or weight may be attached to give the necessary pressure when a tool-holder is employed.

Referring to the drawing, we see that the device consists of an emery oil stone *A*, mounted upon a piece of hardwood *C* by glue, and sliding between two narrow pieces of maple or other hardwood *D*, obtained by sawing a piece through the middle. By using a piece of matched flooring, split in the center, the necessary tongues and grooves are obtained without having to make them. The pieces *DD* are screwed to another piece, which forms the base. To move the mounted stone to and fro an arm *E* extends from *C* to a wheel *G*, having a screw or metal pin holding *E*. Upon the shaft with *G* is a grooved pulley of wood upon which a belt may run, or the pulley may be placed outside the outer bearing and a crank handle attached to it.

JUST GOOD ENOUGH TO DISCHARGE.

I chanced to be in one of the largest wholesale houses of this city not very long ago and heard the manager talking with one of his lieutenants about giving a certain young man employment. The manager asked about the young man's character and habits, and inquired what kind of work he had been doing in the past. After acquainting himself with these points he finally said: "Well, I don't want any more of these kind of men who are just good enough to discharge. I have several of that kind now and I don't know what to do with them. I either want a man who does his work so well that I feel he is deserving of promotion, or else I want him to do it so poorly that I can find grounds for discharging him." It struck me that there was a good lesson for young men who are afraid they are doing more work than they are getting paid for, and who are constantly satisfying their minds with the thought that they are doing their work as well as some one else they know of. Simply because an employer does not find fault with the work his clerks are doing is by no means a sign that he is satisfied. It is just as the manager mentioned above said, it frequently happens that a clerk will do his work in such a way that it cannot exactly be criticised severely, but at the same time he may not show the interest in his work and the abilitp to take the initiative that is desirable in a man who is to hold a responsible position. The clerk who does nothing but what he is told to do should not be surprised if he does not advance very rapidly, even though he may do that work well.—"Omaha Exhibit."

Seidlitz powders are prepared in two parts, each contained in a separate envelope. The alkaline powder, which occupies the blue paper, consists of two drams of Rochelle salts (tartrate of soda and potash) and 40 grains of bicarbonate of soda, and the acid part occupies the white paper, and consists of 35 grains of tartaric acid.

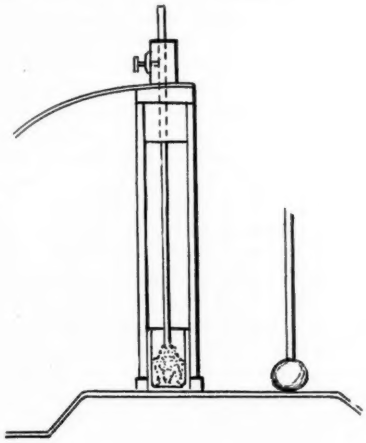
NEW SYSTEM OF WIRELESS TELEGRAPHY.

OSCAR N. DAME.

Passengers on the Sound Line Steamers plying between New York City and local ports in conjunction with the N. Y., N. H. & Hartford R. R., have become familiar with a new wireless installation which appeals especially to enthusiasts on the subject because of its apparently practical nature. This system is known as the Massie system, being the invention of Walter W. Massie, of Providence, R. I.

Knowing that AMATEURR WORK readers are interested in wireless apparatus, a description of these instruments as viewed in operation by the writer is here given.

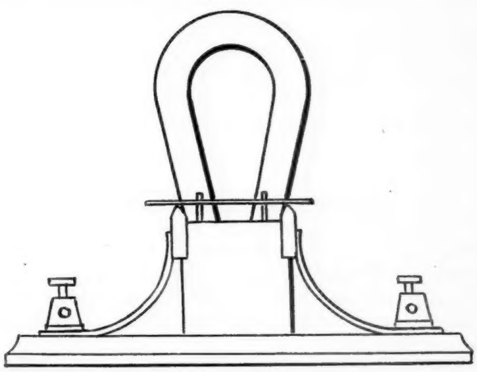
It would seem that the sending end, that is, the induction coil, is of the same type as those used in other systems. The secondary discharge is figured as 50,000 volts. This voltage charges a set of glass plate condensers, which may be adjusted to any desired capacity, and with the disruption of the spark gap, a powerful oscillation is set up in the aerial wires, and such transmission is estimated suitable for 250 miles.



In his coherer, the inventor has certainly accomplished more than his contemporaries, inasmuch as he has developed with simple materials a coherer that responds to feeble waves quickly and positively, and what is more, is subject to immediate decohering without undue tapping. The majority of coherers require blows of considerable force and beside the likelihood of cracking the glass, these violent knocks tend to injure the sensitivity.

This coherer consists of a small glass tube a few inches in length, having a metal cup or plug in the lower end and a brass collar and set screw at the top. A steel spring supported by one end on the baseboard is affixed to the bottom plug. The coherer contains a certain amount of fine silver fillings at the bottom, and on top of this a pinch of soft iron filings. It will be understood that the iron filings are subject to magnetic influence, and the silver ones are not.

Set into an adjustable collar at the top is a fine pointed steel needle, permanently magnetized, the point of which engages a few of the top layers of fillings in such a manner as to crowd them up from the other filings. Thus there is direct connection through the coherer of extremely high resistance. It might be said that the magnetic filings are cohered to the nee-



dle at all times, the direct point of variation being where the two kinds of filings meet. When the oscillating current enters the coherer, the magnetic and non-magnetic filings cohere, greatly lessening the resistance of the circuit and operating a relay as in other systems of wireless receiving.

Decohering is brought about by a tapper which strikes gently against the free end of the spring supporting the coherer. This style of coherer is adaptable to a signal bell outfit and also to a Morse register.

In regular receiving this system employs a detector of the microphone type, which consists of two knife-edge blocks of carbon on which rests a polished steel needle. The oscillating waves vary the resistance of contact so that dots and dashes sound as buzzes in a telephone receiver connected with battery across from carbon to carbon. This method is not new, but has been improved by the addition of a small steel magnet which rests on the baseboard near the steel needle in a position calculated to exert a certain magnetic force upon the needle and hold it upon the carbon blocks so that it can neither vibrate or roll or otherwise impair the efficiency of the dots and dash readings.

This magnet is very effective and the sensitivity of the instrument may be regulated by drawing the mag-

net nearer or further away from the needle in order to meet specific conditions of receiving.

It is said that the resistance normally of the oscilliphone, as the detector is styled, is approximately 40,000 ohms, and after cohesion with the carbon blocks is established by the oscillating current, it drops to about 700 ohms. It would seem, therefore, that this great variation should prove very effectual in long distance work, and the operator informs the writer that shore stations have found this device accurate for fully 150 miles and that it is in daily use between Block Island and Point Judith, and Nantucket Shoals light ship, and also from the railroad shore station at Wilson Point to the Sound steamers of the company.

It would seem, therefore, that these very workable instruments, all of which are covered by patents, would prove very profitable for wireless enthusiasts to study. A sketch of the oscillator, and also of the coherer, is shown, to more fully explain the text. In the oscillator, the two upright pegs behind the steel needle are placed there to keep the needle from rolling upon the magnet. They are short pieces of smooth rod inserted in the insulated block supporting the two carbons and not electrically connected with anything.

CORRESPONDENCE.

No. 115. PLAINFIELD, N. J., OCT. 24, '05.

Will you please tell me if granulated carbon could be used in the coherer (wireless) instead of nickel or other metal filings, thereby eliminating the decoherer? If not, why?

Is it very essential that the particles in the coherer be in a vacuum? W. A. G.

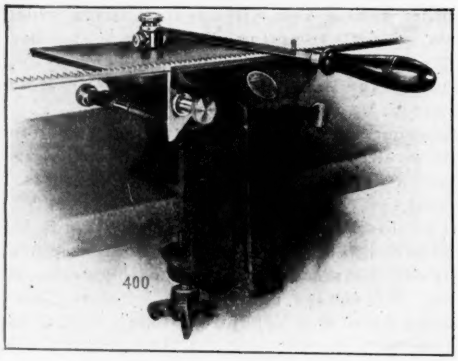
Granulated carbon could be used in a Marconi type coherer in connection with a telephone receiver instead of the relay, but the results would not warrant its use except on a short distance experimental station.

The silver filings in a coherer measure an indefinite number of ohms until the wave crosses the filings chamber, when the resistance drops to a few hundred ohms.

This great variation admits of the use of a sensitive relay, and the supplementary sounder and Morse recorder, while in carbon-granules, as has been shown in the telephone transmitter button, there is a variation in the resistance, but not to a sufficient extent for wireless receiving purposes.

TRADE NOTES.

The accompanying illustration shows a new device made by the New Britain Machine Company, New Britain, Conn., for the hand filing of band saws. It consists of a specially designed automatically-closing vise and of a roller guide which is attached to the end of the file. It is claimed by many that a band saw properly hand-filed cuts better than a machine-filed saw. Hand filing is an art that can only be acquired by constant practice and long experience. The greatest difficulty in hand filing is to give to all the teeth the same shape and to hold the file in a vertical position. The New Britain band saw filer obviates the



above difficulty, inasmuch as the file is guided mechanically in the horizontal direction and is also prevented from turning by means of the roller guide which is attashed to the end of the file. The file, by means of this guide, can be set to any angle and thus the contour of the saw teeth can be maintained uniform throughout the saw. The vise is fitted with a spring which regulates the pressure of its jaws on the saw. When filing, the tension of the jaws on the saw is ample to hold it firmly and to prevent it from chattering, and yet it allows the saw to feed along by a slight pressure of the file from left to right, as a pressure in this direction tends to release the jaws enough to allow the saw to slip, and when the pressure is removed the saw is firmly held, as above noted. This free feeding feature is regulated by a stop pin at the right of the fixed jaw which prevents the over-running of the file when sharpening or feeding. By moving the lever shown at the right of the vise the saw can be easily released when desired.

German papers state that it is a well-known fact that the presence of very small quantities of foreign substances is likely to change the qualities of metals and their alloys materially. Gold is no exception to this rule. Admixture with foreign substances often makes it brittle, while otherwise it is the most malleable and ductile among the metals. Even if alloyed with pure copper, gold shows these undesirable qualities, and such an alloy cannot be used for the manufacture of jewelry, for the coining of metals, or for other industrial purposes.